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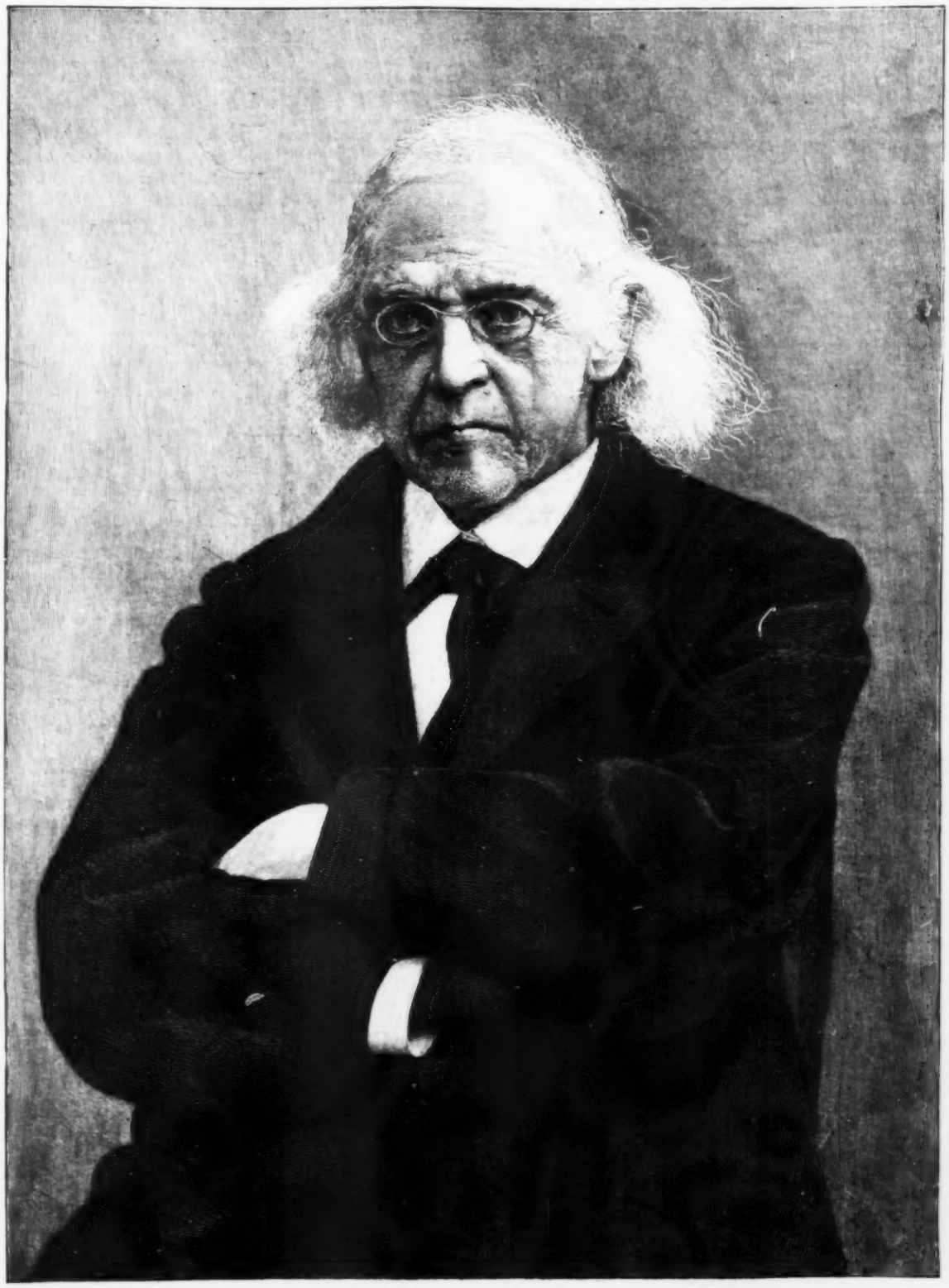
THEODOR MOMMSEN, OCTOGENARIAN.

THE famous men of letters and science are disappearing fast from Germany, and nowhere is their absence more noted than in Berlin. Never particularly attractive to the studious and simple lived, the University of Berlin has for the last half century endeavored to beguile the brightest and most promising men by offering them better salaries and better positions than other universities can pay; but its rivals are now more active than before, and the reputation the Berlin University has acquired for allowing interference with its professors and Privatdozenten when they are charged with socialistic ideas has not done it much good. Still, the course of the rector of Berlin University, newly appointed, has been such as to strengthen the hope that liberalism and free speech will remain to it at least so long as the present incumbent keeps the rector's chair.

Among the old landmarks of the university appears the snow white poll of Theodor Mommsen, somewhat bent, it is true, but not before the enemies of free speech. When one sees him at a public function, with his tall stooping frame and somewhat severe expression, one feels that he is a survival from the romantic epoch of the early half of the century, who has remained as faithful to his early ideals as can be expected of a university professor. At any rate, the lively spirit of the rebel of 1848 is still there, ready to fight with tongue and pen in behalf of his beloved Germany. It was only a few weeks before his birthday, which was on November 30, that he gave evidence of extreme liveliness, almost to the point of invective, in connection with the trouble going on at Vienna between the Bohemians and Austro-Germans. Filled with the old enthusiasm for united Germany, which brought on the revolution of 1848, the venerable professor wrote, last October, a letter to a freind in Vienna, which was so severe in tone that the editor of the Neue Freie Presse did not dare to publish it entire. After deprecating the war of 1866 between Austria and Prussia, he stated that it was a maxim in Germany that, notwithstanding the war, it was certain the Danube would remain as German as the Rhine, and the graves of Mozart and Grillparzer as German as the graves of Goethe and Schiller. But now the "apostles of barbarism" are at work undoing the German work of a half century. Then Mommsen urges union and mutual aid on the Austrian Germans, and continues:

"And the second text is, Be stern! The skull of a Czech will never admit of intelligence, but at least it is open to blows. Much has been sinned and much ruined in Austria through untimely yielding. All is at stake. To give way now is destruction. The Germans of Austria cannot emigrate like the Jews out of Russia. Whoever yields must understand that he will Bohemianize either his children or his grandchildren. Be hard and stern! That is the second text."



THEODOR MOMMSEN.

From this quotation in a letter never denied or repudiated by the old professor, one sees that he is for fighting to retain the privileges which Germans hold above their fellows in Austria of Bohemian or other Slavic blood. Comparatively small in numbers, and scattered over the vast face of Austria, it is only recently that the Slav Austrians have come sufficiently together to make an attempt to share equally with the speakers of German. A law that places Bohemian on a level with German and ordains its use in schools and courts of law is the ostensible reason for the outbursts in Vienna and Prague. The Slav had tasted equality before the government and the law. Too late the Germans perceived that all was up with their former ascendency in the empire.

There is something admirable, yet something grotesque, in the aged professor of Roman history hurling himself into the fray, denouncing the Bohemians and urging that the German Austrians argue with them not with words, but with clubs. It is admirable because one feels that age has not staled the doughty Germanism of the old savant; it is grotesque because one expects from such grave quarters and from one who has behind him so many changes and disillusions a little hesitation in stating that his own party is right and the opposite a set of villains. As a matter of fact, the Germans assume a superiority to all Slavs of whatever stripe which is galling and would, even if it were well grounded, constitute the height of bad policy in a checkered empire like Austria-Hungary.

Theodor Mommsen was born at Garding, Schleswig-Holstein, on the 30th of November, 1817. Graduating at Kiel University, he passed four years in Italy. His earliest published works were on the Romans and the tribes of Italy who were forcibly or peaceably incorporated with them. Having taken a professorship at Leipsic, his work was interrupted by the revolution of 1848, in which ardent, souls like him entirely mistook the German character having nourished a false idea of it in the legends of German freedom in Latin and German literature. The Germans do not like freedom; they enjoy being bossed. This Mommsen did not understand and Bismarck did. Hence Bismarck always reviled men of the Mommsen

type for interfering in politics, a field they did not and could not understand. In 1879, for instance, Mommsen opposed the government's policy of protection, saying it was a swindle, whereat Bismarck gnashed aloud. And just now, since Mommsen wrote that indiscreet letter, in all certainty with the intention that it should appear, Bismarck has attacked Mommsen again under the cover of anonymity in one of his organs of the press.

Mommsen was removed from his professorship in Leipsic, but in 1850 he was too valuable a man to keep in exile; alternately professor at Zürich and Breslau, he was at last, in 1858, installed at Berlin at work on dialects of South Italy, inscriptions on Roman stones, the Etruscan alphabets, Switzerland during the Roman domination—in fine, his prodigious activity was not to be daunted by the driest subject or dulled by twenty different labors. One of his great monuments of industry is the "Corpus Inscriptionum Latinarum," begun to publish in 1863, and in its tenth volume in 1883. The public or state law of the Romans owes much of its clearness to-day to Mommsen. In search of Latin written monuments and inscriptions he has not only pushed up into Switzerland, but over into Illyria toward Byzantium, thus laying foundations for the historian of the Roman and the lower Roman empires.

But with all this grubbing in ancient fields the spirit of Germanism, which made him in Schleswig-Holstein when young an opponent of the Danish influence, and later engaged him in the ranks of those who dreamed that German kings and princes could be swept away and Germany made a single great republic—the spirit of Germanism remains as strong as ever. It was only ten years ago that he was writing on the true site of the battle in which Varus lost his life and legions. In 1870 he wrote a fervent address in Italian to the Italians, among whom he naturally enjoys great distinction, upholding the German side of the French-German quarrel. With pamphlet and verses, this "good professor, but bad politician," as Bismarck has dubbed him, was always ready to spring into the arena and fight for his early love. He has been an active legislator many years, having been a member of the Prussian Landtag, like so many other professors. And along with this political work he had time to plan, begin, oversee, and with the utmost care carry to conclusion great works like his "History of Rome," which began a new era in the method of writing classical history, and his "Coins of the Romans," and "Roman Chronology," and "State Right of Rome," not to mention again the volumes of inscriptions. "Roman Researches" is another book of note, and "Digests," a series of editions of late Latin historians and chronicles.

To the outer world Mommsen is, of course, before everything else, the author of the "History of Rome," which is not complete (five volumes, with the fourth not yet issued, but has been translated into as many languages). He is a fine specimen of the German savant of the past, a man who would not let even the great bully Bismarck cow him, but went his own gait, undisturbed by that clever leader's bluff and bluster. Perhaps he has not always acted wisely; perhaps he has allowed his Germanism to blind him to German shortcomings and the good that is in other races not dead and gone and in their cool, cool graves, like the Romans, and Oscans, and Umbrians, and Etruscans. But the world is better for a man who can do such man's work in learning as Mommsen has. The New World is particularly beholden to him for what he has saved from the wreck of time, working at a period when neither the French, nor the English, nor the Italians appear to have thought it necessary to study the foundations of Roman history. Long may Mommsen remain as young and virile in mind as he is now.—Charles De Kay, in The New York Times. For our engraving we are indebted to the Illustrirte Zeitung.

CHEMISTRY IN 1897.

CHEMISTRY has made steady progress during the year, as might be expected from the number of zealous workers who are striving to solve the many chemical problems that daily occur. In this country, at all events, notwithstanding our shortcomings in reaping the advantages of the results of investigations which, frequently emanating from us, are worked out by our Continental friends, we are not retrogressing in physical and inorganic chemistry, whatever may be the opinion as to our position in applied organic chemistry.

LIQUEFACTION OF FLUORINE.

Moissan and Dewar, continuing the researches of Dewar at low temperatures and utilizing the intense cold which is produced at the temperature of boiling liquid oxygen, have succeeded in obtaining fluorine, which was isolated by Moissan in 1886, in the form of a mobile yellowish liquid at —185° C. In its liquid form it is almost inert to the many substances, such as glass, silica, etc., on which it has so powerful an action in its gaseous condition.

RESEARCHES ON ARGON.

Argon certainly now remains undisputed as being an elementary gas, and appears to be present in many natural gases. Schloesing has found it in fire damp and Regnard in the blood, while Villard has succeeded in combining it with water to form a crystalline hydrate. Argon, like helium, has been found by Ramsay and Collie to be a most inactive element. Lord Rayleigh has met with helium in the natural gases issuing from the Bath springs to the extent of 1·2 per 1,000 volumes, and Olszewski having failed to liquefy it, Dewar has demonstrated how helium can be obtained from the same source in large quantities by his method of liquefaction of the other gases at a low temperature. Dewar has also suggested the method of liquefaction of gases as a means of detecting the impurities that may be contained in air. Arising from the investigations which were made in the isolation of argon, Lord Rayleigh points out how he is unable to corroborate the statement of Sir Humphry Davy that nitrogen dissolved in water is oxidized by electrolysis. If nitrogen could have been oxidized in this manner, argon could have been isolated without difficulty on a large scale.

METALLIC CARBIDES.

Moissan has obtained by direct synthesis a definite crystalline iron carbide of the formula Fe_3C, identical with steel, by the action of the heat of the electric furnace on pure iron and the carbon of sugar, while Bone and Jerdan have caused the direct union of carbon with hydrogen at a temperature of 1,200° C., forming methane without any acetylene or other unsaturated hydrocarbons. The dangers of calcium carbide as a source of acetylene can be avoided according to Vivian Lewes if the carbide is pure, and is kept perfectly dry, and if proper storage of the carbide is insured. In this connection Bone and Cain point out that acetylene forms an explosive mixture when mixed with one-fifth to one-fourth of its own volume of oxygen.

THE BENZENE FORMULA.

Professor Collie has attacked the benzene formula—that fascinating source of interest to many chemists—and has suggested a conception of its construction that may throw a new light on the constitution of many benzene derivatives. The space formula for benzene, as it is termed by its author, combines the hypothesis of the ordinary formula and of the centric formula for benzene, together with the hypothesis that there are two distinct sets of three hydrogen atoms, and that when one set is inside, the other set is outside the molecule. Matthews has since stated that this new space formula for benzene satisfies unexplained modifications in the hexa-halogen addition compounds.

PURPLE OF CASSIUS.

The purple of Cassius has been investigated by Antony and Lucchesi, who have been enabled to prepare similarly colored compounds by adding either cuprous chloride, mercurous chloride, or mercurous chloride and barium sulphate to auric chloride. Inasmuch as the purple precipitates so obtained contain free gold, it is concluded that the original purple of Cassius, which is made by adding a tin salt to auric chloride, is a mechanical mixture consisting of stannic acid colored with metallic gold. This is one of the views which has been previously held as to its composition.

POTASSIUM, SILVER NITRATE, ETC.

A simple instrument has been devised by Newth for the detection of potassium by the flame reaction that absorbs all those portions of the spectrum which usually make the indigo prism fallacious as a test when potassium salts are admixed with salts of lithium, strontium, calcium, etc. Warden has drawn attention to a method of precipitating silver nitrate by strong nitric acid, which has been adopted at the Calcutta Medical Depot to prepare lunar caustic free from copper, also to the apparent action of light in inducing crystallization of stannous iodide.

ATOMIC WEIGHT OF CARBON.

From the Davy-Faraday research laboratory doubts have been thrown by Scott on the methods adopted by Stas, Dumas and others in the determination of the atomic weight of carbon, which, it is asserted, is by no means one of those most accurately known, and that careful revision of it is imperative.

CINCHONINE AND CINCHONIDINE.

In the chemistry of natural drugs many investigations have been made which are of some interest. Koenigs startled the quinologists by the statement that on the supposition that cinchonine and cinchonidine are stereo-isomeric, he had been enabled to convert five per cent. of the former into cinchonidine by the very simple method of boiling with potash in amylic alcohol. Moreover, Shaw subsequently reported that he had been fortunate enough to effect this change to the extent even of twelve per cent.; so if this be correct, quinine manufacturers should have no difficulty in converting a part of the comparatively worthless cinchonine into the more valuable drug cinchonidine. These statements, however, have not been confirmed by Paul and Cownley, who carried out the process exactly as described by Koenigs, and they suggested that the cinchonidine found by Koenigs was more probably due to the known difficulty of separating the cinchona alkaloids and of obtaining them in a state of purity.

HYOSCINE AND SCOPOLAMINE.

Schmidt and Hesse have still to settle the question between them as to the individuality of commercial scopolamine hydrobromide, for while Hesse maintains that it consists of hyoscine and atroscine, which are stated to be natural to the root, Schmidt alleges that it is composed of scopolamine and i-scopolamine, the latter, which is officially inactive, having been produced in the process of the extraction of the alkaloids. But as L. Merck points out, the real question now between Hesse and Schmidt as to hyoscine and scopolamine is merely a question of name, both agreeing to Hesse's original formula of $C_{17}H_{21}NO_4$, and Merck's opinion from the results of careful extraction of scopola root is more in accord with Hesse, and he believes that there are two natural isomeric bases which can be only differentiated by their optical activity.

JABORANDI AND ITS ALKALOIDS.

Jaborandi and its alkaloids have received some attention, and we are approaching to a more definite understanding of the nature of the alkaloids which are present in the various kinds of jaborandi leaves. The early expressed opinion that jaborandi contained only one alkaloid, to which the name pilocarpine was assigned, has been proved to be inaccurate, so that the problem now to solve is to ascertain what is pilocarpine. Paul and Cownley having shown that the several kinds of jaborandi leaves differ considerably in the amount of alkaloid they contain, and that the product obtained is probably always a mixture of two or more distinct alkaloids, and that the pilocarpine salts of commerce differ largely, not only in their physical properties, but also in their physiological action, Petit and Polonowsky have undertaken the study of the two alkaloids, pilocarpine and pilocarpidine, and they conclude that the commercial salts of so-called pilocarpine are, for the most part, admixtures of pilocarpine and pilocarpidine, this being especially the case with the nitrate, which frequently contains 50 per cent. of pilocarpidine nitrate. They also state that pilocarpine and pilocarpidine are isomeric—Merck having previously failed to methylate pilocarpidine—and that the former is transformed into pilocarpidine by heating pilocarpine hydrochloride just above its melting point; moreover, pilocarpidine is natural to the leaves.

DETERMINATION OF DIGITOXIN.

Keller and Fromme have been working at the determination of digitoxin, which, according to Schmiedeberg, is the active principle of digitalis leaves. Fromme finds that the amount of pure digitoxin in digitalis leaves varies from 0·104 to 0·391 per cent.

CONSTITUENTS OF ROSE OIL.

The confusion which has been caused by the application of various names to the constituents of rose oil (otto) and some other kinds of essential oil will be found fully described in The Journal (p. 416 ante), in which it is shown that an alcohol, $C_{10}H_{17}OH$, is a common constituent of rose oil, geranium oil, and of the various essential oils obtained from species of andropogon, and that the name geraniol, first given to the alcohol obtained from andropogon oil by Jacobsen, in 1871, is more entitled to consideration than rhodinol, roseol, réuniol, etc.

FORMALDEHYDE AND ITS POLYMER.

Formaldehyde is maintaining its value as an antiseptic as being more suitable for many purposes than other kinds of antiseptics, and Merck has prepared compounds of it with casein, gelatin and starch. The difficulty of keeping a strong aqueous solution of formaldehyde without its undergoing conversion into its solid polymer, paraformaldehyde, has always retarded its general use. It has, however, been shown by Paul and Cownley how the solid polymer can be readily converted when required into its soluble form, and they suggest that the solid polymer should be manufactured for use as an antiseptic instead of the unstable formaldehyde. The soluble aldehyde which has been prepared from the para compound has been stated by one observer to be even more energetic as an antiseptic than the normally prepared formaldehyde. More information, however, is required on this point.

SYNTHETIC REMEDIES.

Synthetic remedies are still being actively prepared in Germany, some of which may be found to possess the advantages claimed for them. Eucaine and eucaine B, for instance, are being favorably received as being less toxic than cocaine, while holocaine prepared from phenacetin and p-phenetidin has met with some measure of success as a substitute for cocaine. Eupthalamine, a new midriatic, and orthoform, a non-toxic anæsthetic and powerful antiseptic, are among the more important bodies which possess pharmaceutical interest. Euquinine, the ethyl carbonic ester of quinine, is said to be without many of the disadvantages of quinine, and has been found therapeutically to be equivalent to half the quantity of quinine. It has only a slight bitter taste, and is said not to produce cinchonism. Symes has shown how the supposed inimical action of alcohol in pepsin digestion is modified in a membrane receptacle, so that an alcoholic liquid may be used for preparing solutions of pepsin for medicinal use.

ESSENTIAL OILS.

J. C. Umney has done good work on the essential oils of fennel, J. C. Umney and Swinton on oil of citronella, and Braithwaite has improved Herschon's apparatus for use in the determination of aldehyde or of phenol.

HYDROLYSIS OF STARCH.

That there is a relation between the cupric reducing power and the specific rotary power of the products of hydrolysis of starch by diastase was first asserted by O'Sullivan, the one being inversely proportional to the other for all stages of the reaction. The existence of this relation has since been denied by some Continental chemists, but after a searching inquiry by Brown, Morris and Miller, it has been thoroughly confirmed. If a solution of such products shows a rotary power departing from that demanded by its cupric reducing power, it may safely be assumed that an impurity is present. Rolfe and Defren find also that when starch is hydrolyzed by dilute mineral acid, a similar relation holds, although the final product is not maltose, as is the case when the conversion is effected by diastese, but dextrose.

COLORING PRINCIPLES OF TANNIN.

An investigation of the yellow coloring principles of various tannin matters has been carried out by A. G. Perkin, F.R.S.E. A crystalline yellow substance has been isolated from Cape sumac, the young leaves of Colpoon compressum or Osyris compressa, which has proved to be a new glucoside of quercitin, and to which the name osyritin has been given. Quercitin and rutin from quercitron bark and rue respectively are other distinct glucosides of quercitin. Quercitin yields on hydrolysis one molecule of rhamnose, rutin giving two molecules of the same sugar. Lowe's statement that the coloring matter of gambier catechu is identical with quercitin has been confirmed, and acacia catechu also appears to contain a very small proportion of the same substance. The colored principle of Sicilian sumac, Rhus coriaria, is not quercitin as was formerly supposed, but myricetin, and an investigation of Venetian sumac, Rhus cotinus, indicates that its coloring principle is the same substance. The class of tannins found in seeds and fruits contains no member of the quercitin series. They contain, on the other hand, ellagic acid or ellagitannic acid, to which their yellow dyeing property is due. Members of the quercitin group occur in flowers, leaves and stems, but only rarely in seeds and fruits, notable exceptions being Persian berries, which contain rhamnetin and quercitin, and parsley seeds, which contain apiin. The general results show that a very intimate relation exists between tannins and their accompanying coloring matters. The decomposition products, of which gallic and protocatechuic acids, phloroglucinol and resorcinol are typical examples, are found to be the same in the case of the coloring matter as in the tannin.

OTHER COLORING MATTERS.

An exhaustive series of reactions upon apiin and its hydrolytic product—apigenin—has been made by the same author. Apigenin is found to be closely related to chrysin, the yellow coloring matter of poplar buds, and is very probably hydroxy-chrysin, its decomposition into phloroglucinol and para-hydroxy-acetophenone being then clear. Besides quercitin and its mono-

methyl ether, rhamnetin, a third substance occurs in Persian berries named rhamnazin, that has been found to be a quercitin dimethyl ether. Experiment shows that one methoxyl group is present in the catechol nucleus (using Herzig's formula for quercitin), but no knowledge has been gained as to the position of the other, except the fact that it is not in the phloroglucinol nucleus in the ortho position relatively to the carbonyl. Some new light has been thrown upon the constitution of the coloring matter of cochineal by Liebermann. By the direct oxidation of carmine with potassium persulphate he has obtained two substances to which he gave the names coccinic acid and cochinillic acid. The former proved identical with the oxyuvitic acid of Oppenheim and Pfaff, while the latter was found to be a cresol tricarboxylic acid. The positions occupied by the groups being methyl, 1; carboxyl, 2, 3, and 4; and hydroxyl, 5. The constitution of this nucleus is therefore established.

ALCOHOLIC FERMENTATION.

The views hitherto held with regard to the nature of the action of yeast upon sugar in the formation of alcohol will in future have to be modified. As long ago as 1858 Traube held that fermentation was the result of zymotic action, and later Hoppe-Seyler maintained the same theory. Lately E. Buchner has succeeded in producing alcoholic fermentation without the presence of yeast cells. He took pure beer yeast freed from adhering water and ground it with quartz, sand and kieselguhr, mixed this with a little water, and subjected it to hydraulic pressure, thus obtaining a strong solution of the soluble contents of the protoplasm.

This was made clear by filtration, and constituted a slightly opalescent liquid of specific gravity 1·0416. It gave off carbon dioxide on warming, and at 35° to 40° became coagulated. This liquid, when mixed with a strong solution of cane sugar, induced a strong alcoholic fermentation, during the progress of which no organism made its appearance in the liquid. Even when the yeast juice was contained in a parchment bag suspended in sugar solution it was found that carbon dioxide was given off from outside the bag, so that the fermentative enzyme to which this property is said to be due appears to be dialyzable. The property of the liquid disappears with time; being surrounded with ice, it became inactive in five days, although, curiously, it continues its activity over two weeks when mixed with sugar solution.

Rigorous tests have been applied to determine whether the property was due to the presence of fragments of protoplasm in the liquid, and it has been found that filtration through the Berkefeld filter produced no effect, while the presence of chloroform did not retard the fermentation. A 1 per cent. solution of sodium arsenite was also without effect. As these things destroy the action of living yeast, it is evident any protoplasm unprotected by a cell wall would be destroyed more rapidly, and there remains no doubt that the activity is due to a zymotic chemical substance and not a living protoplasm. It is important to notice that Prof. J. R. Green, working precisely by the method of Buchner, with samples of English yeast, has been unable to confirm these results. No diminution of the specific gravity of the sirup or evolution of carbon dioxide sufficient to account for zymotic action could be observed in the course of several days, and it is, therefore, contended that these yeasts, at any rate, contain no alcohol-producing enzyme. This, however, cannot be taken as conclusive evidence of its non-existence, as Buchner himself failed to produce the enzyme from certain samples of yeast.

SYNTHESIS OF CITRIC ACID.

Among other points of interest may be mentioned a new synthesis of citric acid, which has been effected by W. T. Lawrence, who obtained ethyl citrate by the condensation of ethyl bromacetate with ethyl oxalylacetate in the presence of zinc.—Pharmaceutical Jour.

PHOTOGRAPHIC FORMULAS.

THE following are generally accepted as standard formulas, and most of them have been thoroughly tested. In putting up these preparations, as indeed in all photographic work, the most scrupulous cleanliness must be observed.

Every manufacturer of plates has some special formula to which he gives preference, and which is probably the best adapted for his particular brand of plates. These formulas will be found on sheets packed in with each box of plates. Any good developer, however, will work with any standard.

While the pyrogallic acid, or "pyro," as photographers term it, developers are the most popular, they have the great disadvantage for amateurs that they stain the fingers, while eikonogen, hydroquinone, metol and metacarbol developers are less apt to develop stains on the hands of the operators.

It should be borne in mind that all pyro solutions work best when fresh, and only small quantities should, therefore, be made up at one time.

PYROGALLIC ACID DEVELOPER.

CRAMER DEVELOPER.

Alkaline Solution.

Water	12 oz.
Carbonate of sodium crystals (sal soda)	1 "
Sulphite of sodium crystals	2 "

A smaller quantity of sulphite will produce a warmer tone, a larger quantity, a gray or bluish black tone.

The alkaline solution must be kept in well stoppered bottles.

If the negatives show a yellow stain, make a fresh solution, or try another lot of sulphite of sodium.

Pyro Solution.

Distilled or pure ice water	6 oz.
Sulphuric acid	15 mm.
Sulphite of sodium crystals	1 dr.
Pyrogallic acid	1 oz.

Eight grains dry pyro may be substituted for 1 drachm of this solution.

Mix the following proportions:

Pyro solution	1 dr.
Alkaline solution	1 oz.
Tepid water (for winter use)	2 "
Or:	
Cold water (for summer use)	3 to 5 oz., or 240 to 400 c. c.

If the high lights are flat, use more pyro solution.

If they are too intense, use less pyro solution.

If too little pyro is used, the alkali will be in excess and cause fog.

For negatives of great contrast, suitable for line engraving, use double the quantity of pyro solution and add sufficient bromide of potassium solution to keep the lines perfectly clear.

FOR TRANSPARENCIES.

Water	64 oz.
Sulphite of soda	8 "
Carbonate of soda (crystals)	2½ "
Bromide of potassium	30 gr.

To every ounce of this solution add 3 to 5 grains of dry pyro. An excess of pyro will yield slides too heavy in the shadows and lacking in detail in the high lights.

CARBUTT'S DEVELOPER.

No. 1—Stock Pyro Solution.

Distilled or ice water	10 oz.
Oxalic acid	15 gr.
Bromide of potassium	30 "

Then add pyro 1 ounce and water to make 16 fluid ounces.

No. 2—Stock Soda Solution.

Water	10 oz.
Sodium sulphite (crystals)	4 "
Soda carb. crystals (or dry gran. 1 oz.)	2 "
Potas. carbonate	1 "

Dissolve, and add water to make 16 fluid ounces.

No. 3—Bromide Solution.

Bromide of sodium or potassium, ½ ounce (14 grammes). Water, 5 ounces (150 c. c.)

For Developer.

Dilute 2 ounces of stock No. 2 with 7 ounces of water for cold weather and 10 to 12 of water in summer. To 3 ounces of dilute No. 2 add 1½ to 2½ drachms (6 to 10 c. c.) of No. 1. The more pyro, the denser the negative, and vice versa. No yellowing or fogging need be apprehended if the directions are followed. Development should be continued until the image seems almost buried, then wash and place it in the fixing bath.

For instantaneous exposures take for 5×8 or 6½×8½ plate 3 ounces of dilute No. 2. Lay the plate to soak in this, and cover pan. Put 2 drachms of No. 1 into the graduate and 3 drops of bromide solution. Pour the soda solution off the plate into the pyro and back over the plate; let development proceed, and examine occasionally. Keep solution in gentle motion over the plate. A very short exposure may take ten minutes to fully develop. If the image is not fully brought out by this time, add to developer in pan three times its bulk of water, and let plate lie in it covered for half an hour or more if necessary, until full development is attained, then wash, and proceed as directed under head of developer.

HAMMER DEVELOPER.

No. 1—Pyro.

Oxalic acid	15 gr.
Water	32 oz.

Dissolve and add:

Pyrogallic acid	1 oz.

No. 2—Alkali.

Sulphite of sodium (crystals)	8 oz.
Carbonate of sodium (crystals)	4 "
Water	32 "

To develop, take 1 ounce of No. 1, 1 ounce of No. 2, and 8 ounces of water.

EASTMAN DEVELOPER FOR FILMS.

No. 1—Pyro.

Pyrogallic acid	½ oz.
Nitrous or sulphurous acid	30 mm.
Water	32 oz.

No. 2—Alkali.

Sulphite soda (crystals)	6 oz.
Carbonate of soda (crystals)	4 "
Water	32 "

To develop, take No. 1, 1 ounce; No. 2, 1 ounce; water, 2 ounces.

METACARBOL.

Metacarbol	25 gr.
Sulphite of soda (crystals)	100 "
Sodium hydrate (caustic soda)	50 "
Water	10 oz.

Dissolve the metacarbol in the water, add the sulphite of soda, and, when this is dissolved, add the sodium hydrate and filter. With this developer the time of exposure is considerably reduced.

JOHN STRATHMANN'S METACARBOL DEVELOPER.

A.

Metacarbol (dissolved in 3½ oz. water)	25 gr.
Sulphite of soda (15 hydrometer)	3½ oz.

B.

Sodium hydrate (20 hydrometer).

For use take

A	2 oz.
B	1 "
Water	3 "

For undertimed plates use more of B. For overtimed plates use less of B, or use old developer.

HYDROQUINONE DEVELOPER.

CARBUTT DEVELOPER.

A.

Warm distilled water	20 oz.
Sulphite soda (crystals)	4 "
Sulphuric acid	1 dr.
Hydroquinone	360 gr.
Bromide potass	30 "
Water to make up to	32 oz.

B.

Carbonate potash	2 oz.
Carbonate soda (crystals)	2 "
Water to make	32 "

C.—Accelerator.

Caustic soda	1 oz.
Water	10 "

For under-exposure add a few drops of above to developer.

D.—Restrainer.

Bromide potass	½ oz.
Water	5 "

To Develop.

For instantaneous exposures, take—A, 1 ounce; B, 1 ounce; water, 4 ounces.

For portraits—A, 1 ounce; B, 1 ounce; water, 5 ounces.

For landscapes (Sen. 20-27)—A, 1 ounce; B, ½ ounce; water, 3 ounces.

For landscapes, full exposure (Sen. 16-20)—A, 1 ounce; B, ¾ ounce; water, 4 ounces.

For lantern slides—A, 1 ounce; B, ¾ ounce; water, 4 ounces.

For lantern slides and full exposures—A, 1 ounce; B, ¾ ounce; water, 4 ounces; and 2 to 6 drops of restrainer D to each ounce of developer.

Note.—More A will increase density, more B will increase detail and softness. Temperature of developer should not vary much below 65 degrees nor above 75 degrees. The after treatment is the same as with any other developer.

CRAMER DEVELOPER.

For producing great contrast and intensity, and for developing over-exposed plates.

No. 1.

Distilled or ice water	25 oz.
Sodium sulphite (crystals)	3 "
Hydroquinone	½ "
Potassium bromide	¼ "

No. 2.

Water	25 oz.
Sodium carbonate	6 "

To develop, mix equal parts of Nos. 1 and 2.

SEED DEVELOPER.

A.

Hydroquinone	1 oz.
Sulphite of soda (crystals)	5 "
Bromide of potassium	10 gr.
Water (ice or distilled)	55 oz.

B.

Caustic potassa	180 gr.
Water	10 oz.

To Develop.

Take of A, 4 ounces; B, ½ ounce. After use pour into a separate bottle. This can be used repeatedly and with uniformity of results by the addition of 1 drachm of A and 10 drops of B to every 8 ounces of old developer.

In using this developer it is important to notice the temperature of the room, as a slight variation in this respect causes a very marked difference in the time it takes to develop, much more so than with pyro. Temperature of room should be from 70 to 75 degrees Fah.

DR. H. G PIFFARD'S FORMULA.

Sodium sulphite	480 gr.
Sodium carbonate	960 "
Hydroquinone	96 "
Water	16 oz.

Mix and filter. This developer may be used repeatedly.

EIKONOGEN DEVELOPERS.

No. 1.

Water	40 oz.
Sodium sulphite (crystals)	2 "
Eikonogen (finely powdered)	1 "

No. 2.

Water	10 oz.
Potassium carbonate	1 "

To develop, take 3 ounces of No. 1 and 1 ounce of No. 2. As a restrainer, use a few few drops of a ten per cent. solution of potassium bromide.

HAMMER DEVELOPER.

No. 1.

Pure hot water	45 oz.
Sulphite of sodium (crystals)	3 "

Dissolve and add:

Eikonogen	1 oz.

Boil five minutes; when cool, filter.

No. 2.

Pure water	15 oz.
Carbonate of potassium	1½ "

For use, take 3 parts of solution No. 1 and 1 part of solution No. 2.

CARBUTT'S DEVELOPER.

A.

Distilled water	20 oz.
Sodium sulphite (crystals)	4 "
Eikonogen	330 gr.
Hydroquinone	160 "
Water to make up to	32 oz.

B.

Distilled water	20 oz.
Potassium carbonate	2 "
Sodium carbonate (crystals)	2 "
Water to make up to	32 "

For directions see Carbutt's hydroquinone developer.

SEED DEVELOPER.

No. 1.

Distilled or pure well water	32 oz.
Sodium sulphite (crystals)	4 "
Eikonogen	240 gr.
Hydroquinone	60 "

No. 2.

Water	32 oz.
Potassium carbonate	4 "

To develop, take 2 ounces of No. 1, 1 ounce of No. 2 and 3 ounces of water.

HAMMER DEVELOPER.

Hot water	60 oz.
Sodium sulphite (crystals).....	3 "
Eikonogen.....	1 "
Hydroquinone.....	60 gr.
Potassium carbonate	1½ oz.

Or 3 ounces of sodium carbonate (crystals).

To develop, take equal parts of above solution and water. Less water gives more density and contrast.

Other standard photographic formulas will be printed in following numbers.—American Druggist.

LAMBERT'S GLIDING BOAT.

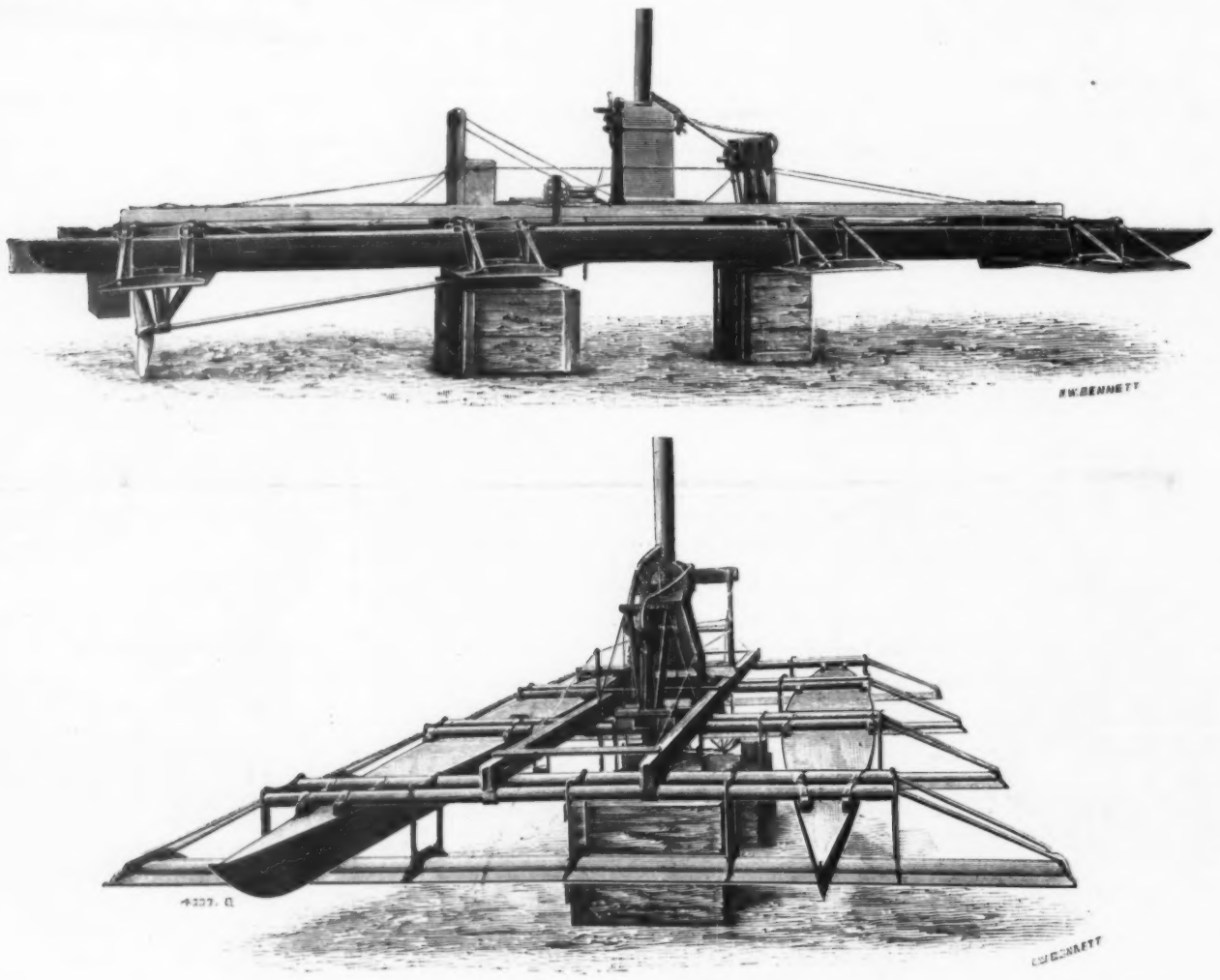
THE idea of making boats to glide on the water is almost as old as naval architecture itself; but hitherto all attempts made in this direction have, we believe, been unsuccessful. Several years ago the problem was experimentally investigated by a distinguished naval architect, who came to the conclusion that it was impossible for a boat carrying its own motive power to glide upon the surface of the water. Count Lambert, of Versailles, who has given much attention to this subject, would not, however, accept this decision as conclusive, and after a long course of experimental research, satisfied himself that it was quite possible to produce a gliding boat that would attain very high speeds on smooth or comparatively smooth water. In spite of adverse opinions expressed by many mathematicians and naval architects whom he consulted, he determined to put the matter to the test.

The illustration on the present page shows a small boat capable of carrying one man. It will be seen that there are two hulls, connected together by metal tubes, and having a central platform which carries the engine and boiler. When the boat is running it is supported on the surface of the water by four blades placed transversely under the hulls. These blades are fixed at a slight upward angle, varying according to circumstances from 1 in 20 to 1 in 30. The total weight of the boat is about 600 lb., and the total surface of the underside of the supporting blades is about 60 square feet. The boat is propelled by a small compound engine and tubulous boiler, the firegrate area being 80 square inches. The screw propeller is 22 in. in diameter and 30 in. pitch.

Upon the engine being started the boat gradually rises to the surface; this being completely accomplished when the speed attained is about ten miles per hour. Beyond this speed the boat rises still higher, until only the extreme back edges of the blades touch the water. The highest speed at present reached is a little more than twenty miles per hour, measured on a course 150 yards long, the time being taken very carefully by a Benson chronograph.

The machinery employed to propel this boat was designed for a totally different purpose, the proportions of the cylinder passages being suitable for an extreme speed of 600 revolutions per minute; but when the boat is traveling at 20 miles per hour it has to run at about 800 revolutions. As the result of a large number of trials, it would appear that not much power is required for propelling the boat after it has once commenced to glide. This statement is supported by the fact that when the engine is traveling at a high speed it does not consume much steam, the boiler being worked with the fire door full open. No doubt very much better results would be obtained if the engine were capable of running at a higher speed of revolution, as then the propeller need be one-half its present diameter and pitch. These trials are very interesting from a scientific point of view, irrespective of any practical value they may have, and we propose publishing fuller data at a future date. Count Lambert's invention has been carried out by Mr. Horatio Phillips, of Harrow, who is known to our readers in connection with experiments with flying machines.

We are indebted to London Engineering for the engraving and description.



LAMBERT'S GLIDING BOAT.

THE PNEUMATIC TIRE.

SIR DAVID SALOMONS' theory as to the merits of the pneumatic tire is fully corroborated by the results of experiments made in the United States, a paper on which was read before the association of Master Carriage Builders of Chicago. The tests were made with two buggies—one with steel tires of 44 in. and 48 in., the other with pneumatic tires of 32 in. and 34 in. The weight of the former was 254 lb., and that of the latter 332 lb., while the diameter of the tires was 2 in. The weights of the two were, however, made exactly alike by the adjustment of additional weights. The first test was carried out upon smooth pine flooring, and the wheels were drawn lengthwise of the boards. The amount of power required was found by means of a spring balance attached by long cords, and these tests were repeated alternately with vehicles empty and loaded with 300 lb. of added weight.

To start the pneumatic vehicle from stand-still to a haul at a slow pace the power required was from 3½ lb. to 4 lb. For the steel-tired wheels the power was found to average 3 lb., and when once started the power required was but 1¼ lb. to 2 lb., thus showing an average difference of 50 per cent. in favor of the steel tires. When obstruction was caused by placing bodies ⅛ in. high in front of the wheels, the power required to haul from a stand-still was for the steel tires 25 lb., and for rubber tires only 11 lb. When drawn at a slow pace over similar obstructions, the power for the rubber tires was 5 lb. and for the steel tires 8 lb. When loaded with 300 lb. weight, the power required for the rubber tires was 8 lb. and for the steel tire 12 lb. on the smooth road. Upon the ⅛ in. obstacles, the rubber tire required 13½ lb. and the steel tire 40 lb.

The average of the tests showed that to haul the steel-tired vehicle over obstructions it required an excess of about 25 per cent. of power. It is only right to point out that had the wheels of the rubber-tired vehicle been as large in diameter as those of the steel-tired, the superiority of the pneumatic tire would have been slightly increased. A good deal of misapprehension exists among cyclists and others as to what constitutes the real merit of the pneumatic tire. There is a popular notion that by the use of this tire certain mechanical advantages are gained. This is only true, however, under certain conditions, and Sir David Salomons, in a paper read recently before the Society of Arts, explained what are the conditions which render this tire advantageous, as well as its mechanical disadvantages. Unless the tire is inflated to a proper degree, and unless it is of sufficient diameter that the stones most generally met with on the road sink into the tire, its main virtue would be gone.

Indeed, if the springs of a carriage are sufficiently well made and adjusted—a circumstance rarely to be found—the advantage of the pneumatic tire is almost absent, and for motor traffic the steel or solid rubber tire will prove the favorite in the long run, where sufficient attention is given to carriage springs. The chief function to be fulfilled by the carriage springs is to enable the load to travel on the level, while the wheels of the under-carriage are mounting up and down as they pass over road obstructions. The weight of the portions which rise and fall is very small when compared with the vehicle and its load. Although it has been asserted that the draught is greatly diminished by the use of the pneumatic tires, Sir David says his own experience does not bear this out except in given cases. On bad roads an advantage may be gained, but on good ones the steel tire carries the palm. It is quite possible to make a pneumatic tire suitable for very heavy roads, but the thickness and size would be so great that the advantage to be derived would be virtually absent.

In the case of cycles and motor vehicles of that type the pneumatic tire is an undoubted advantage, for in one case it removes much of the vibration from the feet which is conducted to the body, and in the other it might be found difficult to introduce suitable springs on the ground of weight and expense. When pneumatic tires began to establish their right of existence, the Gummi Zeitung, according to The Trade Journals Review, pointed out that the rubber industry should not leave the repairs to outsiders, who would undertake such work as badly paying troublesome jobs, and bring the rubber into discredit. To a certain extent this warning has been left unheeded. Many a tire, which a skillful rubber man could easily cure, is rejected as not worth bothering about.

A new tire is of course bought, and the trade does not suffer. Not for the present. But we must not forget that cycling is just now largely a matter of fashion. Everybody cycles because everybody else does. That may last some time; the high price of cycles certainly will not. The cycle manufacture is no longer as risky as in the days when new styles crept up every week. But the production is enormous, and there are, after all, some people left who prefer using their legs without the intermediation of treadles. Those who already possess wheels will be pleased to know of hospitals to which to send invalids. The Radmarkt devotes an article to repairing workshops. The shops need not be high nor very large, but nothing else should be done in them: plenty of water and soap and French chalk should always be at hand, all dust avoided, the tables should pull out, and racks be provided.

We require further a good stock of brushes, from the finest narrow pattern to coarser brushes more than an inch in width. These should be kept in benzene. how, it would be interesting to learn, since benzene is so very much inclined to run away and evaporate. The seams to be stuck together must be dry; they are

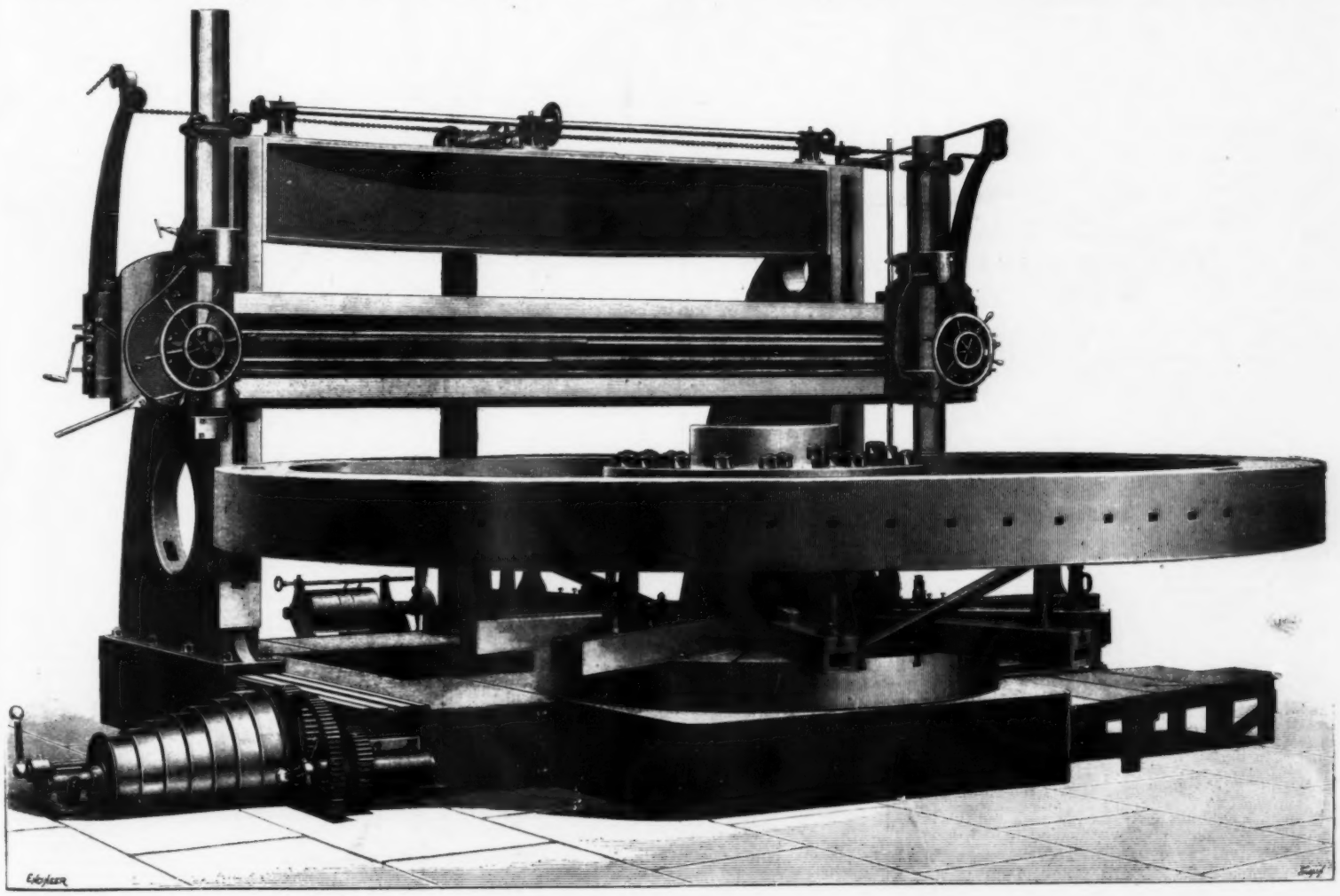
best pressed by a little roll of steel with a handle. The rubber solution should be kept in vessels provided with taps or with pneumatic or other pistons, always be diluted before use, and not wastefully applied. For occasional use, tubes filled with solution would be preferable. The scissors should give a cut with inclined, not vertical edges. When electric incandescent lamps cannot be had, the illumination of the shop might be effected through the windows from outside.

A LARGE BORING MILL.

THE boring and turning mill, or, as it is more commonly called in this country, the horizontal lathe, is rapidly gaining in popularity. The ease with which work can be adjusted on it and the steadiness with which it lies, as well as the facility in the management of the tools, are all points in its favor. We in this country have not, however, gone as far in this direction as American engineers. We publish an engraving of a very large boring mill, constructed by the Niles Tool Works Company, of Hamilton, O., and 39 Victoria Street, London. It is shown operating upon a flywheel 23 feet 6 inches in diameter. The rim of the wheel is 18 inches square. The weight before turning was 139,611 pounds, the weight afterward 128,421 pounds—57 tons; so that 11,190 pounds were removed. The area of the face of the rim or periphery is 110·7 square feet, and of the two sides, 207·3 square feet, making a total area of 318 square feet. The work was finished in two cuts, thus making a total turning of 636 square feet, and as this was, we are informed, removed in forty-eight hours, the average speed of work comes out at 13¼ feet per hour.

These mills are very powerful, and heavy cuts and feeds are the rule in using them. Frequently, on cast iron, feeds as heavy as ⅛ inch per revolution are used, the depth of cut varying from ¾ inch to ½ inch. In America it is a rule to take all the stock off at the first cut, no matter how much material there may be to remove. The second cut, then, will simply be to finish the piece and make it a true job. Operating the mills in this manner makes their production far greater than that of a lathe. In boring out holes of large diameter, the boring tool can be put directly into the tool holder at the lower end of the bar, which insures a greater rigidity in boring. For convenience and strength in thus using the bar there is no comparison with it in ordinary lathe practice. To accomplish only approximately the same result on a lathe would mean that a special boring bar would have to be mounted on the carriage of the lathe at great expense of time and labor. Where holes smaller than the diameter of the bar are to be bored, the tool holder can readily be removed from the bar, and a boring bar of as large a diameter as the bored hole will permit can be inserted into the tool bar, and by use of the double-end cutter at the lower end of the boring bar, very rapid and accurate work can be done. Attention should be called to the rapid adjustment of the feed as applied to these mills. The feed being driven by a friction plate on the right hand side of the mill, is capable of an infinite variety of adjustments, so that the feed can be adaptable to any class of work. This is an advantage of great value, as it enables the operator to adjust the feed to the utmost work the cutting tool will do.

The tables in the mills made by the Niles Tool Works are carried on a central spindle resting below on a steel step, but an angular bearing under the outer edge of the table is provided, and, when heavy pieces are to be machined, the central spindle is relieved and the table allowed to rest lightly on this outer bearing, which is freely flooded with oil. The boring or turning bars are balanced by chains in the way shown. We are indebted to The London Engineer for the cut and copy.



BORING AND TURNING MILL.

AUXILIARY ENGINES AND TRANSMISSION OF POWER ON NAVAL VESSELS.*

By GEORGE W. DICKIE, San Francisco, Cal., Member of the Society.

UNFORTUNATELY, on government vessels, the work which has to be done by machinery is divided up and placed under the cognizance of various bureaus, each having a decided preference for some particular mode of transmitting power, the result being that in one ship we are very likely to find three different methods of transmitting power in use, and no one in charge master of any one method.

In mentioning three methods of transmitting power in use on our naval vessels we exclude steam, that being the original form in which the power at present is generated, and therefore can be distributed without any reconverting mechanism.

In our investigation of the various methods in use we will consider not only what they at present are, but what they might be if all that is known in regard to them were utilized in the installation, and we will assume that, first, all operations on a warship requiring power can, with properly designed mechanism, be performed by steam direct from the boilers.

Second, all operations on a warship requiring power can, with properly designed mechanism, be performed by water under a high pressure imparted to it by steam-operated pumps.

Third, all operations on a warship requiring power can, with properly designed machinery, be performed by air under pressure imparted to it by steam-operated air compressors.

Fourth, all operations on a warship requiring power can, with properly designed machinery, be performed by electric motors, using a current generated in a central station by steam-driven generators.

We see no mechanical difficulty in the way of steam being applied direct to all auxiliary machinery. Its elasticity, it is claimed, renders it difficult to train heavy turrets by this agent, and we are satisfied that, to have full control of accurate movements of such heavy masses by steam, some very reliable controlling device must be introduced. For this purpose we have been introducing into recent designs a continuous and automatic hydraulic control, which should make all movements of a steam-operated turret as accurate as those operated by hydraulic motors.

Those who claim that steam should be converted into some other form of energy and distributed to the various machines base their claim on three points of advantage—safety, economy and comfort. The presence of steam pipes in all compartments of a war vessel must be considered in connection with the business in which the vessel is to be engaged, and that is to fight. In action these pipes would all have to be open at least from the forward turret to the steering engines in the stern, and are more or less subject to damage. It would be difficult to overestimate the loss which might result from a broken steam pipe in any compartment under the main deck of a war vessel in action. Such an accident might not only involve the loss of all men in such a compartment, but the total disablement of the ship as a fighting machine.

It is difficult to determine the relative economy of steam as applied direct throughout a ship and as applied through some other agent. The great source of loss is through condensation. Nearly all the machines which use steam in naval vessels, outside of those directly connected with the propelling of the vessel, do so intermittently, and masses of metal must be heated up every time a movement is made. There is no doubt that a large portion of the steam used goes to renew lost heat in this way, and is condensed without doing any useful work; besides this source of waste, the steam engines used for auxiliary work are of necessity of the most wasteful character.

The objection to the direct use of steam on account of the discomfort caused by heat in places difficult to ventilate efficiently is, perhaps, the most serious objection made to this method of power distribution. Steam and exhaust pipes running to the various machines must be carried, as a matter of safety, below the protective deck line, and, for the same reason, all engines requiring to be operated in time of action are also placed below that deck, where ventilation is very difficult, even where there are no engines; but with steam engines in or under handling rooms, and in recesses formed in ammunition passages, and with battle hatches closed, it is difficult to see how men can possibly carry on the work of tending such engines, serve ammunition hoists, and perform all the duties required of the under deck force in time of battle. Physical endurance has always been a prime factor in action, and no method of distributing power should be adopted in a warship which renders it impossible for every man to do his duty in the time of trial.

We may now consider our second assumption, that all operations on a warship requiring power can, with properly designed machinery, be performed by water under a high pressure imparted to it by steam-operated pumps.

In our paper read before the Division of Marine Engineering and Naval Architecture of the International Engineering Congress, the question of hydraulic transmission of power on warships was very fully discussed, and the general proposition of a central hydraulic station within the inclosure containing the main engines and boilers, where the water would be placed under pressure by pumps operated by the most economical type of steam engine, under the immediate supervision of the engineer officers of the vessel, and its manner of distribution, was fully set forth.

During the four years that have elapsed since that paper was written, and in view of whatever experience has been gained on the subject during that time, we are still of the opinion then expressed, that most of the

* Digest of paper presented at the New York meeting (December, 1897) of the American Society of Mechanical Engineers, and forming part of volume xix of the Transactions.

work required of auxiliary machines on warships can be better done by hydraulic than any other means of transmission; and if so, how about the qualities we considered in connection with steam applied direct—safety, economy and comfort?

In considering the question of safety we must not only take into account dangers resulting from accident to the means of transmission, but the danger which might result to the vessel as a whole if this means of transmission was not as reliable in its action as any other means of transmitting power.

The danger we pointed out from the possibility of damage to a steam pipe where steam was used direct does not exist in connection with hydraulic transmission; the result being simply cutting out of service the machine to which such a pipe leads. As to reliability, our experience proves that after the first difficulties are overcome there is no form of power transmission which can be depended upon with more confidence than hydraulic.

Partial hydraulic systems are now on warships under the care of officers who have had no opportunity to become expert in hydraulic work, and who in many cases do not believe in its application, and yet the record of failure at any time to perform the functions required is a remarkably clean one.

Granting that this system is eminently safe, is it an economical method of distribution?

It has generally been allowed even by those who are most strongly in favor of its adoption that, owing to the conditions which govern the operation of most auxiliaries on board warships, economy must be sacrificed when a hydraulic system is adopted. Hydraulic motors for any of the varied purposes requiring power on warships must be designed large enough to meet the maximum requirements of the service, and if these motors are of the piston or plunger type, the regular form at present in use, the maximum amount of power will always be used, although the minimum work only is required.

If, instead of using a motor having cylinders with moving pistons or rams, utilizing the pressure to obtain power, and measuring out a given quantity of water for each movement, irrespective of the work to be done, the pressure water was applied to a properly designed wheel of the tangential type, an efficiency averaging about 70 per cent. could be obtained with a great variation in the load, and thus one source of waste with this system would be avoided.

The direct ram would be still retained for certain purposes where the precision of movement is of the first importance, such as in steering gears and gun training movements.

The American mania for direct acting steam pumps to generate power for such an installation is the most fatal obstacle to be encountered in any effort to reach reasonable economy in a hydraulic system of power transmission on board our warships. In some of the battleships now building it is proposed to install for the generation of hydraulic power say six duplex hydraulic pumps of 400 gallons capacity each per minute at 600 pounds pressure per square inch; this requires 12 steam cylinders 22 inches diameter and say 24 inches stroke, being with pump friction about 950 horse power. This will require with the type of pump proposed not less than 95,000 pounds of steam per hour, and this certainly would give on the main engines 5,000 horse power. Half the total boiler power of the ship with forced draught would be absorbed by such a pump installation, if working at its full capacity.

This is the main reason why hydraulic power is condemned, on account of the fuel required for the regular daily practice with the mechanism now operated by water on those ships so fitted.

There is no reason why hydraulic power should not be generated by as economical steam engines as any other form of energy.

As to comfort: The presence of hydraulic pipes in any of the living spaces, storerooms or magazines in no way affects the temperature or ventilation of such spaces. Branch pipes in very few cases need exceed 1¼ inches in diameter. Any leakage is easily discovered and can do no damage. The working of all water motors can be accomplished without noise, and, there being little or no change in the temperature, all joints when once tight are likely to remain so, and this is the one great comfort always attending a well designed and carefully installed hydraulic system of transmission.

Our third assumption, that all operations on a warship requiring power can, with properly designed machinery, be performed by air under pressure imparted to it by steam-operated air compressors, may now be considered.

Perhaps no form of power transmission has all the elements of safety in the same degree as compressed air. A leak in the transmission pipes improves the ventilation and adds to the comfort of those working in that compartment. The pressure carried, of say six atmospheres, makes all kinds of connections simple and easily cared for. Double bottoms and difficult places of access can be purified and ventilated by a small jet from the distributing pipes. Water may be excluded from any damaged compartment which can be made airtight down to the level of the opening that admits the water. The writer floated one ship—the "Jessie Osborn"—which was stranded on the rocks north of San Francisco Bay, when great sections of the bottom were entirely gone, by stiffening and calking the hold deck and by means of an air compressor forcing air under that deck, thereby forcing the water out through the open bottom, lifting the ship up to almost her light draught.

Any compartment in a warship using a compressed air system of power transmission can be promptly cleared of water by this means, the extent of the aperture by which the water enters being of no consequence. This being kept in view in designing and building the vessel, would render this method of transmitting power one of the greatest elements of safety and give an immense added value to the under-water compartments; so that, should one or more compartments be damaged by either striking a rock or being struck by a torpedo, such compartment would simply be put out of use, but by keeping it charged with air to a pressure equal to the draught of water of the vessel, its buoyancy would not be impaired if the damage was in the bottom, as it most likely would be.

We have mentioned this advantage in the use of compressed air because it is the only one of these three systems of power transmission which can be so used in connection with the general safety of the vessel.

In the matter of economy, both in generating and in distribution, the compressed air, if proper methods are adopted, should be at least equal to any of the other systems which have been tried. The compressors used should be of the most modern type—triple expansion of steam and triple compression of air, and with storage enough to meet sudden calls.

No system is so well adapted to the installation of

FIG. 1.

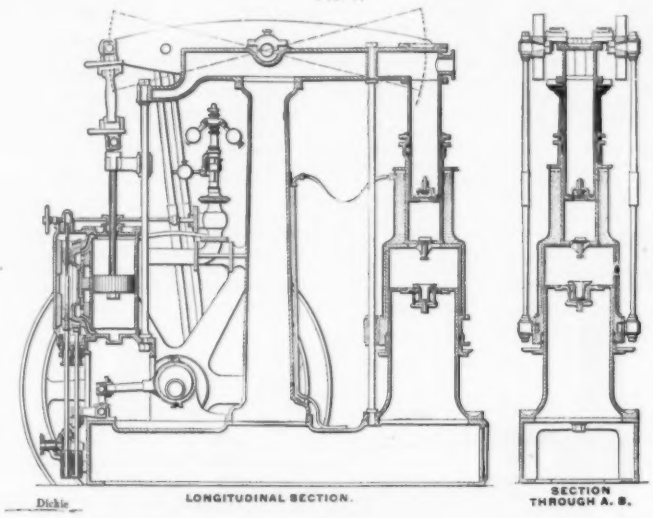
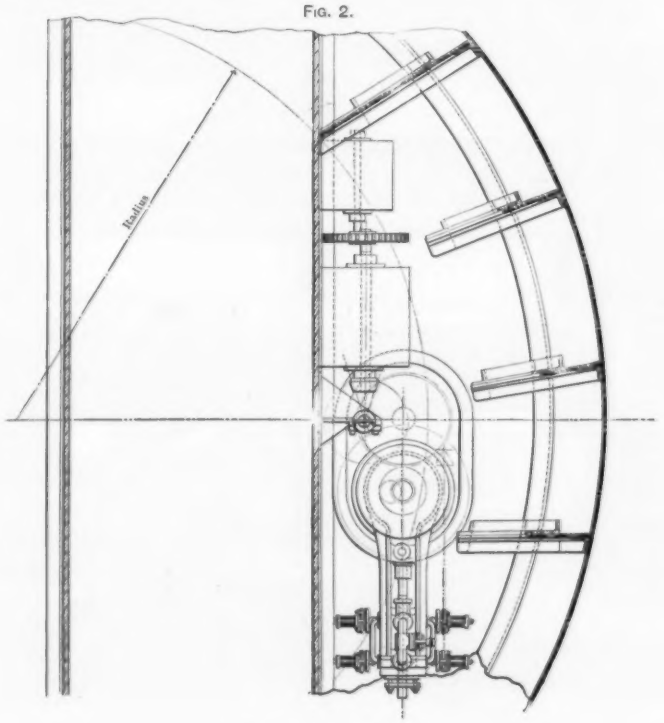
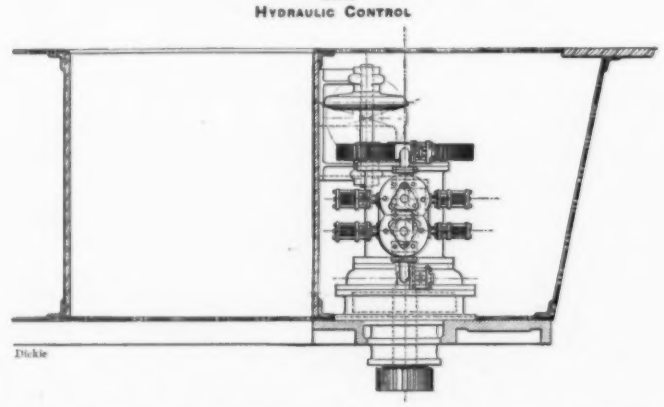


FIG. 2.



ELECTRIC TURNING GEAR WITH HYDRAULIC CONTROL



power being made to equal the average required instead of the maximum. Soliani mentions the success obtained by Prof. Riedler in compressing air in two stages. This method of compressing has during the past few years become almost universal where any degree of economy is aimed at, and, while it has no direct bearing on the subject of generating power for transmission through a warship, yet, in justice to ourselves, we desire to state that in 1876 we designed an air compressor which was built for use at the Crown Point Mine, Virginia City, Nevada, in which the air was compressed in two stages and the steam expanded in two stages; that is, both the steam and air ends of the machine were compound. We published a plan and description of this air compressor in 1877 in a book on Hoisting and Pumping Machinery, from which we quote the following:

"The compressor (Fig. 1) consists of two fixed rams, one of 26 inches diameter, secured to the bed plate, and another of 12 inches diameter, secured to the entablature; between these rams and upon them is a sliding cylinder, water jacketed all over. Between the large and small ends of the cylinder is a valve opening upward, and on the head of the large ram and the butt of the small ram are valves opening upward.

"Suppose the sliding cylinder on the bottom center and the steam cylinder piston at the top, steam being admitted on the piston; the sliding cylinder will rise and take air through the valve in the head of the large ram until it reaches the top center. The space above the large ram will then have air at the atmospheric pressure. Steam then being admitted to the other side of the piston, the sliding cylinder descends, the valve in the head of the large ram closes, and the valve between the large and small cylinders opens, and the air during this stroke is compressed into the small cylinder. During the next up stroke this compressed air is forced through the valve in the bottom of the small ram into the receiver at the same time the air is being taken again through the valve in the head of the large ram.

"The work of compression is thus extended over

two strokes, or a complete revolution of the engine, and more time is obtained for abstracting the heat generated in the operation. The valves, which are only three in number, all litt upward, and need no device to seat them. All of the valves remain open during the greater part of the stroke, and have not such a quick action as when the compression is done in one cylinder with the delivery valves open for a small fraction of a second at the end of the stroke.

"We also consider the ram better than the piston, as any leakage is at once seen and readily stopped.

"The steam cylinder for this compressor is also fitted with a variable cut-off.

"In large machines of this class we would make them double, using two compressor cylinders moving in opposite directions, and a compound condensing engine where water could be had.

"Compressed air is being used to such an extent in the mines that anything which will tend to cheapen the compressing will have its effect on the fuel bills."

With the most economical steam engine, operating the most economical compressor, and the compressed air converted into useful work through economical air motors, this system of power transmission on warships should meet every requirement on the score of economy.

As to comfort, we have already pointed out some of its advantages. No return pipes are required, as in all other systems, electricity not excepted. The liberated air from motors will ventilate and cool the spaces in which they operate, and these spaces are usually the most difficult to ventilate.

In the hydraulic system all losses by leakage must be made up by fresh water manufactured on board, whereas by this system the more loss, the better it feels where the loss has occurred, and the feeling of absolute safety in case of any break in the transmission pipes must add to the efficiency of the men whose duty requires them to work beside the motors and the pipes which supply the power to them.

All the machinery required in such a system of transmission is of a character now well understood by the engineer officers on our warships, and the difficulties attendant on operating mechanism not understood by the operator are avoided.

Our fourth assumption, that all operations on a warship requiring power can, with properly designed machinery, be performed by electric motors, using a current generated in a central station by steam-driven generators, now remains to be considered.

The advocates of this system have a foundation for their method of power transmission which those who favor any of the other methods do not possess, in the fact that all modern warships have a certain amount of power converted into electric energy and distributed throughout the ship for lighting purposes.

While there is no difficulty in generating electricity by the use of water or air motors, there is the waste of converting the steam into one form of energy and converting that again into another form of energy. To justify such a course, it would be necessary to prove that water or air as a transmitting agent possessed, for all purposes but lighting, a great advantage over any known method of electric transmission.

This, in the present condition of the art of transmitting power by generated electricity, cannot be maintained. We must therefore concede that the electric method has the advantage of undisputed possession of the field for at least one part of the work to be done.

The transmitting wires of the electric system possess a flexibility which cannot be claimed for the pipes of the other systems. This is an important advantage in the crowded compartments of a warship.

As to safety, economy and comfort, we may now consider these in comparison with other systems.

In regard to safety: We might safely take it for granted that whatever disturbance would fracture the pipes of an air or water system would part the wires of an electric system. In that case the danger to life and also to the ship would be far greater with the electric system than with the others.

There is also a growing fear among marine engineers that certain materials are rapidly destroyed by electric action, caused by the hull of the vessel becoming magnetized in some way the nature of which is not yet fully understood.

As to economy: The electric generating plant has been developed both electrically and commercially into a high degree of efficiency. Direct operated generators are now driven by engines of the very highest developed type. These engines are so perfectly controlled by automatic valve governors that full load or no load may be the condition without apparent change in the working of the steam motor.

The generators may be so divided into units as to meet the conditions of work at any time without much of the steam engine power running without load. Lighting and power can be taken from the same installation, thus effecting a saving in the labor of attendance. There is no doubt that the economy of generating the power electrically will be better than with either water or air, owing to the high speed of the engines and the small amount of loss in the generating mechanism.

In regard to the distribution, the losses, by careful installation, can be reduced until they shall at least not exceed the losses of friction in either air or water pipes of the other methods. Careful designing may also reduce the losses in converting the electric energy into mechanical movements, so that the economy of this part of the system may be better than in either air or water motors.

In operating large turrets where the mass to be moved and controlled is very great, and on a continually shifting plane, we believe that some controlling mechanism of a special character will be required to insure successful and accurate movements of such masses on a moving platform.

For this purpose we have introduced a hydraulic control device, consisting of two hydraulic cylinders (Fig. 3), double acting, their pistons operated by a double throw crank shaft, which forms one of the transmitting shafts between the electric motor and the fixed rack under the turret. These cylinders are charged with water or oil. Motion of the turret revolves the crank shaft and moves the pistons in the cylinders. The fluid must pass from one side to the other to permit of such motion. This it does through passages connecting the ends of the cylinders. There are two such passages, one being controlled by a valve operated from the sighting station, and is opened as the current is turned on to the motor. The other is controlled by a spring-loaded valve and gives a fixed maximum control. This is necessary, as, if the hand control were closed too quickly, the momentum of the moving mass would break the mechanism.

We also propose to avoid great waste of current in starting this heavy mass, by using a small high-speed motor to effect the first movement, or for small movements of the turret. If it is necessary to throw the current into the main motor, a certain speed is reached before that is done; consequently the shock and waste of current is avoided, as the main motor would only be used when a high speed of train was required, and then only after the inertia of the mass has been overcome. In making these movements, the small motor is allowed to reach its load when the current is switched into the main motor. The current in the small motor also excites a solenoid, which by proper mechanism couples the shaft of the small motor with the pinion that, through a gear of say 10 to 1, works the shaft of the main motor; but when the current is turned into the main motor, the solenoid is cut out and the clutch withdrawn, thus leaving the small motor at rest.

Fig. 2 is a sketch of a small portion of a turret, showing the motors, gearing and hydraulic control. The actual economy which would result from such a method of operation could only be determined by actual experience. But we feel confident that it would prove to be in advance of the economy possible with either air or water.

One other reason for expecting a good economical result from a complete electrical power transmission lies in the fact that this system would receive more skillful attention on the part of the officers in charge than any of the other methods mentioned. The whole installation would be more attractive to the educated engineer. It is the fashionable power of the day, and young men are more eager to give their attention to this than to any other form of generated energy; and if any system is the thing desired by those who are to have the operating of it, that system will give better results, will be more carefully nursed, and will be studied in all its details, with the object of improving every result obtained. This is natural, and must be considered in connection with any proposed advance in engineering methods.

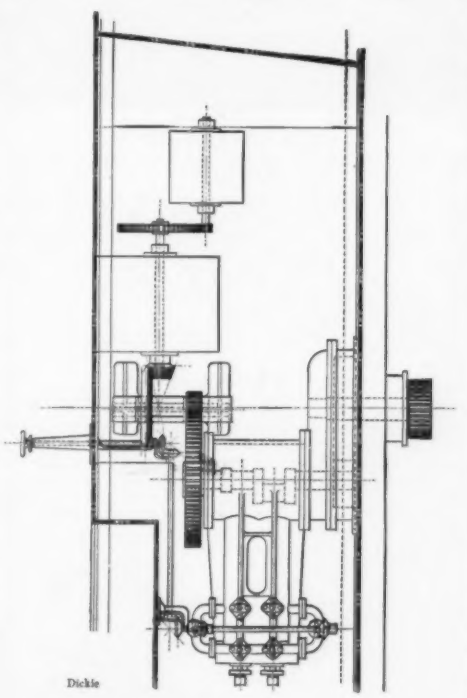


FIG. 3.

Some time ago we were fitting the Howden system of forced combustion to a vessel, the engineer of which did not believe in its merits; but he was honest, and assured us that he would do nothing to prevent it being a success. It was necessary to find another engineer who would do everything he could to help make it a success before success came.

So the fact of electric transmission being desired by so many engineers is one point in its favor which will secure the care that means economy, apart altogether from the inherent qualities of the system itself as compared with others.

In regard to comfort, it cannot be claimed that an electric system of power transmission on a warship, like a compressed air system, can be made the means of increasing the comfort of living on board. On this point it should rank with a hydraulic system. The facility with which electric energy can be converted into rapid rotary motion makes ventilation wherever that power is distributed a very simple matter, and electric fans, both fixed and portable, especially where little or no heat is generated, would supply pure air to all parts needing artificial ventilation.

A LACK OF WHALEBONE.

THIS is the time of year when the men who prepare whalebone for the market are busiest. And, as it happens, whalebone is just now scarcer than ever before, says The Philadelphia Press.

"Whalebone was hard to get last year," said one of the largest dealers in the commodity, "but this season's supply will be a good deal smaller than that of 1896. A short time ago there were advices that eight whaling vessels were stuck in the ice away up north, and according to the latest news from that region there is danger that they will not be able to get out at all this season. If they do not, the shortage will continue, and that will mean hard times for us, since, although the price is high, we can make no sales if we have no bone. But if the ships should escape—it is hardly possible that they may even now have forced their way out of the ice—we shall have good trade at satisfactory figures.

"They have made a fair catch, but they will not bring south a large enough supply to break the market. Ruling quotations now range from $4.25 to $4.50 a pound, but the $5 mark will be reached soon, whether the imprisoned ships succeed in getting free or not.

"Nearly all the bone used in the United States is brought from the Arctic by Yankee whalers, although a little comes from the South Seas and some from Japan. The supply from all quarters is much less than formerly. The demand, too, is nothing like what it used to be, despite the great increase of population, for all sorts of celluloid, 'feather favor,' cork, rubber, steel and other substances have been very generally adopted.

"The high grade—'shell' bone—goes into first-class corsets, and is used for stays in costly gowns, the demand for these purposes being so great that this quality is put into nothing else, except certain surgical instruments. The 'grain' bone goes into the cheaper corsets, whips, etc. The two qualities differ greatly, the 'shell bone being without grain and easily worked. While it is not one whit less elastic than the other, it can be pierced or bored without danger of splitting, but this is not true of the 'grain' bone, which, as its trade name indicates, is made up of fibers that are prone to split apart."

Most of the "cutting" of whalebone, as those in the business term its preparation, is done in Paris and Bremen. A little is done, too, in London, and there are seven cutting establishments in the United States—four in New York, two in Boston and one in San Francisco. It seems strange that the industry should be so slightly represented in San Francisco, the great port for the reception of the raw bone, but in that regard this business does not differ from some others, notably sugar refining, which is chiefly carried on in New York for the entire United States, and cotton milling, which is carried on in England and New England for the whole world, despite the fact that the world's sugar and cotton crops are raised thousands of miles further south.

Five years ago the supply of whalebone was as phenomenally large as the present supply is small. There had been an unusually heavy take after several lean years, and at least 250,000 pounds, worth $4 a pound, or a cool $1,000,000 altogether, was stored in a little brick and stone structure on the Potero shore of San Francisco Bay.

This unprecedented and never since approached supply was as carefully guarded as if it had been made up of golden eagles. Not that there was much danger of its being stolen—for whalebone is stored in such heavy masses that it cannot easily be taken away—but it is a decidedly inflammable substance, and there was great fear of fire. The storehouse is a perfect vault, with walls of brick and stone and iron roof and iron doors. A perforated pipe, from which the whole place could be readily flooded in case of a sudden outbreak of fire, runs all around the top, and when the store of bone is large, trusted watchmen guard the place night and day.

There is always great danger to whalebone from rats—pests which are extremely numerous on the San Francisco water front, especially in the fall, when the whaleships make their appearance. In order to make sure that these sharp-toothed destroyers shall be kept out, small iron doors, grated in small meshes, have been put in. When the big doors are opened for ventilation—and whalebone must be treated to plenty of fresh air—these grated screens are shut. As rats' teeth, though potent, are not quite hard enough to negotiate cold iron, this precaution has always served its purpose admirably.

Because of the possibility of fire, the men who receive the bone from the ships are always in a hurry to get through with it. As soon as a bone-laden craft docks, a big force of men is employed, and they pitch in and transfer the cargo with all possible haste, working night and day until the task is done. And as soon thereafter as it is feasible the whole batch is put aboard ships and railroad trains for the East, there to be distributed to the American and European "cutting" establishments.

From a thousand to three thousand pounds of bone are furnished by each whale, the latter amount, however, being decidedly exceptional. Before leaving San Francisco the bone is split, sorted according to color and tied up in bundles. After splitting, the pieces are termed "stalks" or "slabs." They are from three to eight feet in length, when ready for shipment, and weigh from three pounds to six or seven.

When received by the manufacturer, each slab is fringed with strong, glossy black hair. This has a separate value of its own, and is used in certain furniture manufactures; also, mixed with horsehair, in brushes. After it has been shaved off the slabs are scrubbed vigorously, and then put to soak in water for about a week. When sufficiently softened, they are subjected to the action of hot steam in strong receptacles of special design. They are then ready to be split into "shell" and "grain" bone. After that they are cut into stays, whipstocks, etc.

The utmost pains has to be taken with the bone from the time it is removed from the head of the whale until it is safely through the manufacturing process in order to prevent "nicking." Although it has to be thoroughly softened before being regularly "cut" in the factories, it is exceptionally tender at all times, and the least carelessness will sometimes greatly reduce the value of a slab even when resulting "nick" is so slight as hardly to be noticed on inspection. It is considered a great breach of commercial honor for a dealer in bone to offer a nicked bundle without making known the defect, and all such lots are carefully marked "cut" in San Francisco.

Whalebone is often spoken of as the jaw, but this is really a misnomer—the bone of commerce being really cut from the teeth, of which there are 437 in the jaws of every whale. A fair-sized front tooth is worth quite $50 at present prices, and the entire head of a big whale represents a good deal of money.

STORY OF THE YUKON.*

GETTING INTO THE YUKON.

To make a commencement of the subject, we will assume that we want to visit the Yukon country. I may say that I object to the use of the name Klondike, because that is so small a portion of the territory we have up there in the Yukon region, in comparison with which the area of the Klondike is an insignificant quantity; and nearly all that vast stretch of country has yet to be prospected. I will first introduce to you the several routes into this gold-bearing region which are now known.

Leaving Victoria by any one of the steamers which run from here, we make our way through the well known Seymour Narrows, taking care to time the passage to reach there at a suitable stage of the water, for it is well known that no ship can go through except at either high or low tide because of the terrible current at other stages. In a few days, according to the capacity of the steamer, we reach Port Simpson, the most northerly seaport in British Columbia or Canada on the Pacific Ocean.

If we wish to make our way further in British bottoms, we can here take the river steamers and proceed from Port Simpson to Wrangel, it being about 170 miles from the former point to the mouth of the Stickeen River; proceeding up that river about 150 miles, or perhaps a little less distance, as will be found when the surveys are made for the proposed railway facilities. That distance occupies sixty hours or more.

From the head of the Stickeen the road would follow through an undulating country which presents no serious obstacles to railway construction, and for the greater part of the distance of 150 miles is pretty well covered with timber. Mr. W. T. Jennings, C.E., who lately made an examination of that route for the government, gave me some notes on it, and asked me to say that the natural food supply for horses or cattle, as he saw it, was not more than sufficient to feed a couple of hundred head. Any greater number would soon crop it bare. Those contemplating entry by that route may take this as a warning and carry with them a sufficient quantity of food to obviate any risk in this direction, otherwise the consequences may be serious. The surface consists of low, sandy ridges, interspersed with swampy ground, the passage of which is difficult for pack animals.

Arrived at the head of Teslin Lake, we produce our whipsaws and commence to get out lumber for our boats.

DOWN THE TESLIN LAKE.

The boat will be finally got ready, and then commences the trip down the Teslin Lake, which is eighty miles long and bounded on both sides by high mountains. This lake takes its name from that of a large fish that is found in its waters. The Hootalinqua, or Teslin River, is about 125 miles long, or a total distance from Victoria to its confluence with the Lewis of about 1,300 miles by this route.

At two points only are there hindrances to navigation on this river. One of them reported to me, a short distance below the lake, consists of a number of islands, with narrow, shallow channels between. In the autumn there is not more than two and a half or three feet of water through, but as the bed of the river is gravel and the distance is said to be not more than a couple of hundred yards, this could be amended by opening the best channel and concentrating nearly all the water in the river there.

The other obstacle is even less serious than this. It is further down the river, and, as I understand it from report, consists simply of a sort of dike of rock running across the river somewhat higher than the general bottom. In low water it is said a steamer might touch this in passing over it, but this also could be remedied easily and cheaply.

TAKU'S GLACIER.

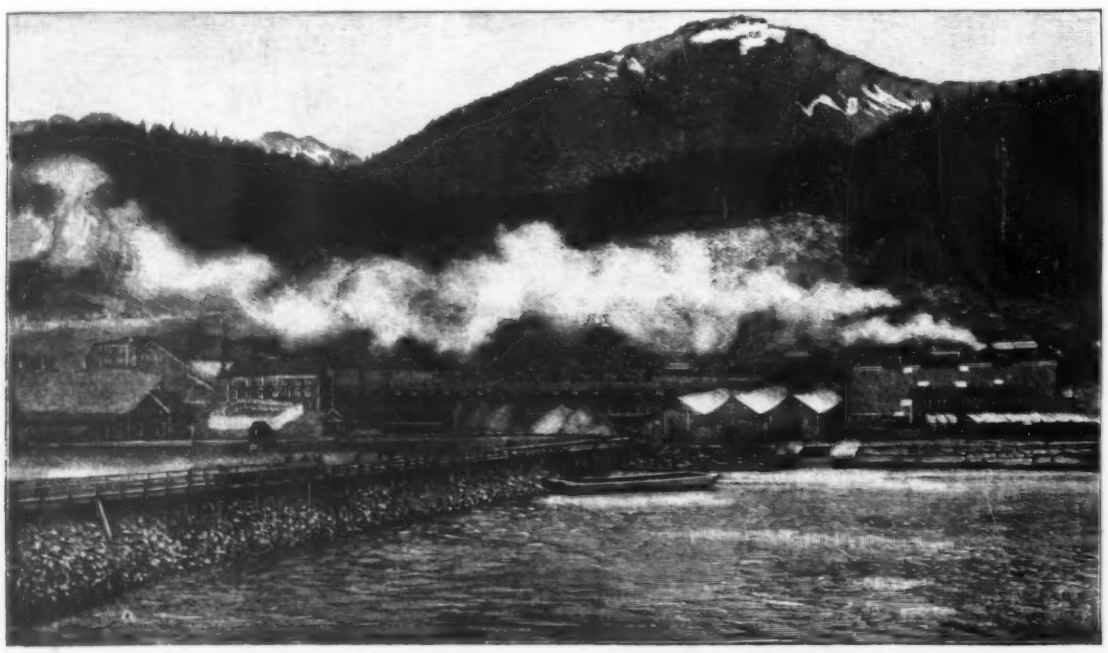
I leave you now at the mouth of the Teslin and go back to Wrangel, where we take an American boat to Juneau. There has been in the last few months some talk in regard to a proposed route by way of Taku Inlet. In 1894 and 1895 I was instructed to go into that portion of the country.

Taku Inlet is about eighteen miles long, and heads in a glacier of the same name, which is the liveliest glacier I have seen in Alaska. In the summer of 1893 I was camped for three weeks in its vicinity, and several times every day the noise from its discharges of ice was like salvos of artillery, and often could be heard distinctly at a distance of twelve or fifteen miles. It keeps the head of the inlet almost continuously full of ice, many pieces of which are veritable icebergs. The tides and the winds play with these and keep them drifting back and forth around the head of the inlet to such an extent as to render it almost useless as a harbor. Compared with this, it seems to me the celebrated Muir glacier is tame indeed. I visited it three times, and never saw it discharge any ice.

Taku River, which empties its waters into this inlet about two miles below the glacier, runs over a pretty wide valley, and is full of sand bars that divide the waters into many streams, rendering it somewhat doubtful for steamboat navigation. I have heard it stated that this river was navigable for steamboats, but this is very questionable. During the months of June and July an ordinary river steamer probably could make her way up to the first forks—some sixty miles—but no further.

From the forks, the route from this inlet follows the left hand or Nakinah branch, up past the mouth of the Slocoh branch, joining from the west, and up which there is a route over which the Indians travel to Tagish Lake. The Indians report this as an easy route.

VIEW OF JUNEAU.



STAMPING MILL OF THE TREADWELL MINE, THE LARGEST IN THE WORLD.

* Mr. William Ogilvie, F.R.G.S., who for years has been employed principally in the exploration of the vast northland of Canada, and is conceded to be the greatest living authority upon all matters concerning the far northern portion of America, has very recently returned from Dawson City. As he has been on the spot and seen with an expert's eyes the birth and development of the Klondike district, as well as the discoveries at Forty Mile and Birch Creek, which in a manner led up to the opening of Bonanza and El Dorado, his views, based upon personal observation, coupled with scientific knowledge, must at the present time possess a double value. What he has to say as to the Yukon country generally, the several routes giving ingress to it, its natural resources and mineral formation, as well as the glimpses which he permits of the life of the miners at the fever period of the rush, are presented here. The above is the editorial note from The New York Sun. We condense our article from this paper.

with two low summits to cross; but it offers no distinct advantage over the next two routes I notice.

About eleven miles above the mouth of the Slocoh, we leave the Nakinah and go up the valley of a small stream which flows through a rocky defile that might appropriately be termed a cañon. We follow this about four miles, and turning sharp to the right, ascend the valley of another small stream some four miles to the summit. There would be considerable difficulty in the last eight miles in the construction of a railway, but from here on to Teslin Lake, some fifty or sixty miles, I do not apprehend any serious hindrance to construction of a suitable road.

While on the ground I noticed that a portion of the worst of this route might be avoided by going around a mountain to the westward of it, which seemed to me at the time to afford easier grades and a more suitable country, but which would be several miles longer. I have since learned that an engineer who was sent last summer to search for a route through this country examined the latter part and found it practicable. This route, as does the Stickeen, takes us to the head of Teslin Lake, from where they are one.

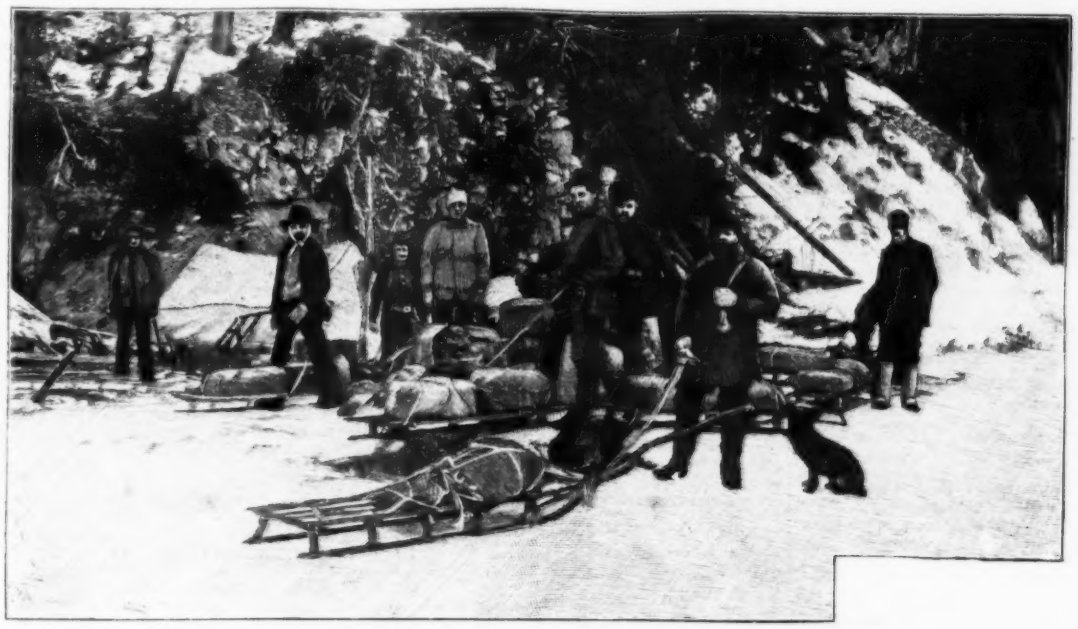
TWO ALL-CANADIAN ROUTES.

We have here, then, two routes, one of them offering to us the advantage of a river which is certainly navigable for fair sized steamers during several months. They both offer the advantage of being all-Canadian routes, because in the Anglo-Russian treaty of 1825, while Great Britain conceded a coast strip to Russia which was to be bounded by the summits of the mountains running parallel with the sea—except where such summits were more than ten marine leagues from the coast, in which case a line ten marine leagues distant was to be the boundary—she at the same time reserved the right to navigate forever, freely and without hindrance, all streams, rivers, bays and inlets leading from the interior to the waters of the ocean. Under this article we clearly have the right to navigate both the Taku and the Stickeen, for which reason they may both be termed all-Canadian routes, but it appears from what we know at present that the Stickeen is best adapted for the purpose.

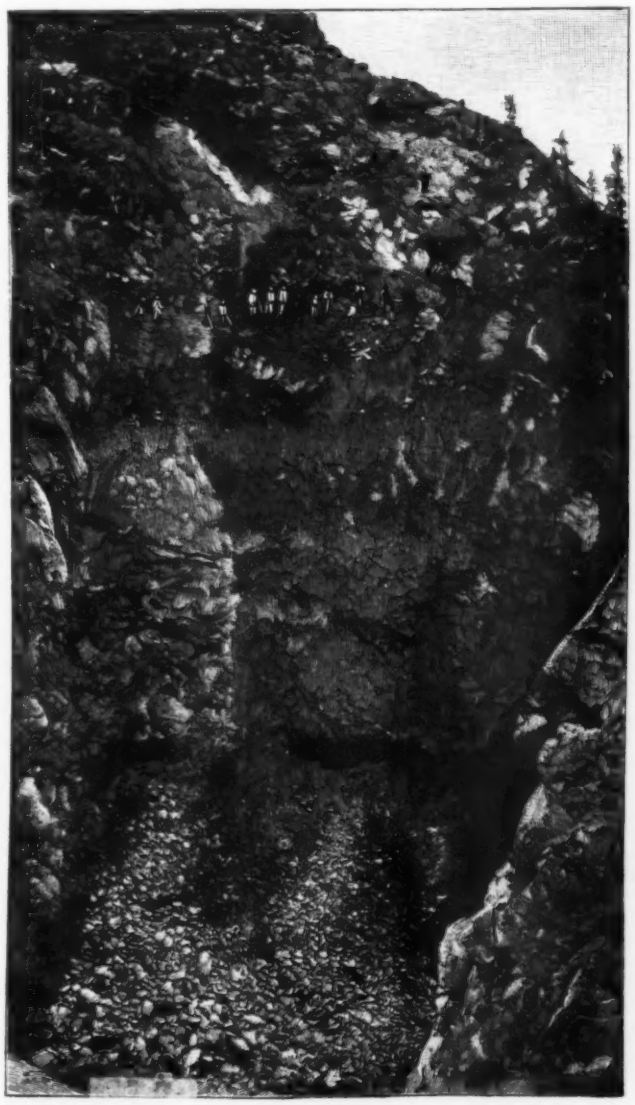
VIA SKAGWAY AND DYEA.

We go back again to the coast now and proceed a hundred miles from the Taku up to Skagway, where we find the celebrated White Pass route. From tide water to the summit of the White Pass is a distance of about seventeen miles, four miles being through a flat, timbered valley. Above this the valley becomes contracted, and any road built through to the summit would necessarily have to keep very much along the hillside. The summit is about 2,600 feet above tide water, from where the remainder of the thirty-five miles to Lake Bennett is undulating, rocky surface, with very little soil for filling or grading purposes.

We now return to Skagway, and go through by the Dyea route, which has been used by the Indians for



GOLD MINERS AND PACK CARRIERS ON THE CHILKOOT PASS.



THE TREADWELL MINE.

FISSURE IN THE MUIR GLACIER.

generations. And it is evident that the Indians knew their business in selecting this route. The word "Dyea" is itself an Indian one, meaning "pack" or "load"—a very appropriate name for the trail. From tide water to the mouth of the cañon it would be easy to build a road—as easy almost as to construct one along a city street.

From the mouth of the cañon to Sheep Camp construction is more difficult; in fact, it would probably be necessary to suspend the road by iron girders from the side of the cliff. From Sheep Camp to the summit is still more difficult, as all who have gone over the road will heartily agree. It is in many parts very steep, especially the last bit at the summit, where an ascent of over 500 feet is made up a very steep incline covered with masses of broken rock, which add much to the difficulty of the climb. In the months of February, March and April, and, in fact, May and June, this is smoothed by the snow, which falls on it to the depth of fifty or sometimes sixty feet; so that it is only in the months of July, August, September, and October that this difficulty presents itself. The summit is about 3,600 feet above tide water.

Between the summit and Lake Lindeman, a distance of about fifteen and a half miles, there is a fall of about 1,320 feet. During the summer months three lakes in this stretch, aggregating something over four miles, lessen very much the hardships of packing. The pack trail, though at places a little rocky, is not difficult.

WHERE FIERCE WINDS BLOW.

Lake Bennett, where we ended our White Pass route, is separated from Lake Lindeman by a sandy ridge about three-quarters of a mile across. The upper twelve miles of this lake averages a little more than half a mile wide and is comparatively shallow. About fifteen miles down the southwest arm of the lake joins, and down this latter fierce winds blow which frequently get up a very ugly sea, decidedly dangerous for small boats, as I have myself experienced, being twice windbound there for three days.

Caribou Crossing, which is about two and a half miles long, brings us to Tagish Lake, about seventeen miles in length as traversed by this route. Between Tagish Lake and Marsh Lake there is about five miles of river that is easily navigable for any ordinary river steamer, the shallowest part being at the head, where even at the lowest water I think four feet can be found. The rest of it is ten or twelve feet in depth. On the bank of this river, about one and a half miles below Tagish Lake, the Canadian police and customs officers are stationed.

Marsh Lake is about nineteen miles in length, and from it to the cañon is about twenty-five miles. For a fair sized boat the cañon is easily practicable. Its length is about five-eighths of a mile, and the run through is made in about three minutes. To make the run successfully, keep your boat in the middle of the channel. If you allow it to be caught in the eddies on the sides, it is immediately whirled round and round and is probably dashed against the steep basaltic sides. It is almost imperative, to avoid this, that enough men be in the boat to keep good steerage-way on her by rowing. If not, the steersman soon loses control of her, very probably with the result before mentioned.

Just at the foot of the cañon are three heavy swells, where, if the boat runs fast, she will dip water. To avoid these, incline her a little to the left and pass them. When once past these swells turn sharply to the right, and a few powerful strokes will bring you into an eddy, which will land you, whether you will or not, on the eastern bank.

Below this rapid less than half a mile of smooth water, in which there are two sharp bends in the river, brings you to the head of the White Horse. Now the White Horse has been run by a great many boats, and by many successfully. But I have traced the death of thirteen men by drowning at this point in the summer of 1895, and I fancy that is a large percentage of those who attempted to run it in that year. Many who escaped lost their effects or suffered damage by water. It is a very nice thing to talk of running the White Horse after you have gone through it, but it takes much of the glory off when you have to admit that you lost most of your outfit or got your boat full of water. I would strongly recommend you to pack your outfit past this, and if you must run the White Horse, do so in an empty boat.

THE DALTON TRAIL.

I know the Dalton trail only by report.

The summit of this trail is about forty-five miles from the coast and 3,000 feet above the sea. The watershed is about seventy-five miles from the coast and Dalton's trading post 100 miles. Thence to the Pelley is about 200 miles further. This route passes over a nice, undulating plain, well timbered in the valleys and with grass on the slopes, although not enough to feed any large number of animals. Mr McArthur asked me to say that 200 or 300 animals passing over it would soon crop it bare, and I make this statement as a warning to those who may be contemplating entry by that route.

The first thirty-four miles of the Dalton trail is in disputed territory; the rest of it is in Canada, just as is partly the case with the Dyea and Skagway trails, too. Now, for my part, I think it is our duty as Canadians to sink all political differences—to let the fire of patriotism consume all feelings that would tend to retard the construction of an all-Canadian route to our own gold fields, so that we may enjoy as fully as possible the benefits that region will bring if we use our rights wisely and well.

We have the best end of the Yukon River—that is certain. The steamers of both companies trading in that region have several times ascended as far as Fort Selkirk, at the mouth of the Pelley, and have never found any difficulty in so doing. In fact, one of the companies wintered its steamer here for several winters. In going down the Yukon in a steamer recently from Dawson City to the mouth, I noted no trouble until we got down to Circle City, to get into which we had to cross a shallow gravel bar, which required careful navigation.

TROUBLE ON THE YUKON BARS.

Below Circle City the river spreads out over what is known as the Yukon flats, and every year there is more or less trouble in navigating the waters here. In the past summer both companies had boats stuck here for several days. One of them lay on a bar for three weeks, and could be got off only by digging the bar from under her—cutting a canal, as it were, in the bar, and letting her slip into it. Another boat stuck near the same place for several days until a sister steamer came along and butted her over, but in doing so stuck on the same bar, and I don't know how long she stayed there.

The navigation of the Yukon River in the upper part is open from May until the middle of October, but at the mouth it is not open before the first of July, and navigation does not last longer than the 1st of October—that is, only from two and a half to three months—and it takes river steamers fourteen, fifteen, and sixteen days to get up the river to Dawson. St. Michael, the headquarters of the river boats, is eighty miles from the mouth of the river, and only in calm weather can the steamers cross that bit of open sea.

SHIFTING CHANNELS.

In addition to this the bars at the mouth of the river often catch steamers on their way both in and out, and delay them hours, even days.

The two companies which have traded on the river in the past had plying on that stream in August last a fleet of seven steamers—four the property of the Alaska Commercial Company and three of the North American Trading and Transportation Company. These are fair sized boats, capable of carrying from 350 to 400 tons each, and they make three, four or five trips per season, as conditions suit or necessities require. There were also two other smaller steamers in course of construction at St. Michael in August last, but they were too small to affect the transportation question materially. I believe that it is in contemplation by the two companies named to place more steamers on the river for the coming season.

THE DISCOVERY OF GOLD IN THE YUKON.

Next let me tell you something about the discovery of gold in the Yukon. Early in the seventies an attempt was made to get over to Teslin Lake by Cassiar miners who had learned of the existence of a large lake northward from Cassiar. Several men tried, but unsuccessfully, and returned disgusted. In 1872, September 2, two north of Ireland men from County Antrim, named Arthur Harper and Frederick W. Hart; George W. Fitch, who came from the vicinity of Kingston, Ontario; Andrew Kanselar, a German, and Sam Wilkinson, an Englishman, left Manson Creek to go on a prospecting trip down the Mackenzie River.

Harper, because gold had been found on the Liard, which empties into the Mackenzie and is one of its principal branches, was under the impression that there was gold on the Mackenzie. They made their way down Peace River, by the Finlay branch, to what is known as Half Way River. There they met a party of men surveying for the Canadian Pacific Railway, and unwittingly helped to drive a spike in our great national highway, because they gave their boat to the survey men to make their way up the Peace River. Harper and the others packed their provisions up the Half Way River and over a twenty-five or thirty mile portage to the waters of the Nelson River, down which they went until they found it safe for the passage of canoes, where they made a cache and proceeded to make two dugouts, with which to ascend the Nelson.

In 1891 I was sent by the Dominion government to examine the northeast portion of this province, and coming out by the trail followed by Harper, I saw the cache which Harper had told me about in 1887. Well, Harper's party made their way down to the Liard River, where they met two men named McQuesten and Mayo. Wilkinson determined to try his luck on the Liard, and left the others. Harper, Hart, Kanselar and Fitch went down the Mackenzie, across to the Peel, and thence over to Bell's River, an affluent of the Porcupine, and down the Porcupine to Fort Yukon, where Harper saw an Indian who had some native copper which he said came from White River.

Harper determined to try for it. With Fitch and Hart he went four hundred miles up the Yukon to White River in September, and thence up White River until they were stopped by running ice, when they made preparations for winter, building a cabin of suitable dimensions.

From this point they made prospecting excursions in various directions, mainly in search of the copper, which they did not find. Harper attributes their non-success to the late closing of the river and the thickness of the ice drift, which precluded any attempt to cross it. He believes he saw across the river rock of such peculiar colors as to justify him in at least assuming that he had found a copper vein of considerable extent. He kept that matter a subject of inquiry with the Indians during his long sojourn in the country, and now thinks that he is certain of its location, having from time to time obtained from the Indians of the locality pieces of native copper and copper ore, all of which seem to him to point to one locality. Where this is he did not tell me, but he hopes, if he lives long enough, to be able to discover and prospect what he considers a very extensive copper district.

THE FIRST PROSPECTS.

In the spring, being short of provisions, they made their way down the river, prospecting as they went, and found very good indications in the vicinity of the mouth of the Stewart. But the shortage of provisions prevented their taking advantage of these discoveries. On their way up they ascended Forty Mile River two or three miles prospecting, and found very good prospects, but the Indians whom they met on that river scared them away by telling them that there was a very dangerous and impassable cañon some distance further on. We now know this is not the case. They found no gold on the Mackenzie, and the result of their prospecting Harper summed up to me thus:

On the Nelson, nothing; on the Liard, colors; on the Mackenzie, nothing; on the Peel, fair prospects; on the Porcupine, colors; on the Bell, nothing; and on the Yukon, prospects.

To obtain provisions they had to make their way to St. Michael, and on their way back they encountered McQuesten and Mayo, who had gone into the service of the Alaska Commercial Company. Near the mouth of the Koyukuk Harper saw an Indian with some gold which he said came from a mountain in the vicinity. Harper spent the winter of '74 and '75 prospecting at the point indicated, but found nothing. McQuesten and Mayo, as the result of a conversation with him, went up the stream and established Fort Reliance in August and September, 1874. Harper joined them the following summer, and a partnership was formed which existed until 1889.

CLOSE TO THE KLONDIKE IN '74.

Fort Reliance is only six and a half miles from the mouth of the renowned Klondike. While trading it appears that they made very few and short attempts at prospecting. The valley of the Klondike and its affluents is a favorite hunting ground, but they never prospected there, and if they had done so in the Klondike itself they would have found nothing, for its bed consists of coarse gravel through which fine gold would have soon gone out of sight, and at that time no prospecting was done except surface work. In the summer of 1887 the valley of the Klondike was prospected

SIZE AND FORM OF THE GOLD NUGGET FOUND BY KONRAD DAHL IN 1894.

for upward of forty miles, with no result. Again, in 1893, it was prospected and nothing found.

Early in the eighties gold was found on the Stewart River by miners, prominent among whom were two brothers named Boswell, from Peterboro, Ontario. There is little doubt that much of the early mining done in the country was due to the reports of Harper, who had written to old comrades in British Columbia, where he had mined for many years, trying to induce them to try their luck on the Yukon. In 1886 Mr. Harper erected a trading post at the mouth of the Stewart for the benefit of the miners there, some thirty or more in number.

In the same year coarse gold was found on Forty Mile. Now, as coarse gold is what all miners principally search for, as soon as this discovery was made known Stewart River was deserted. Harper left Stewart River in June, 1887, and went down to the mouth of the Forty Mile, where he began the erection of a residence and trading house, the nucleus of the famed town of Forty Mile. The Forty Mile was prospected its entire length, and to enumerate the creeks and gulches on its headwaters on which gold was found would now be a waste of time.

FINDING THE KLONDIKE.

As I have before told you, we own Miller and Glacier creeks, besides some others affluent to Sixty Mile. I will now proceed to show you we own a vastly larger area and also much richer.

The discovery of the gold on the Klondike, as it is called, although the proper name of the creek is in Indian "Troan-dik," was made by three men, Robert Henderson, a Canadian, a native of Prince Edward Island; Frank Swanson, a Norwegian; and another man, named Munson, whose nationality I do not know, who, in July, 1896, were prospecting on Indian Creek.

They proceeded up the creek without finding sufficient to satisfy them until they reached Dominion Creek, and after prospecting there they crossed over the divide and found Gold Bottom, an affluent of the Klondike, where they got good prospects and went to work. Provisions running short, Henderson retraced his steps to the mouth of Indian Creek, leaving the other two at work. From the mouth of Indian Creek he went up to Sixty Mile, but, failing to obtain a supply there, he had to make for Forty Mile. On the way down he passed an old mining comrade named George W. Carmack, a native of California, who had associated with him two Indians, Tagish Jim and Tagish Charlie, natives of the upper waters of the Yukon, who proudly claimed to be "King George men," or British Indians.

Now one of the articles of the miner's code is that he shall proclaim all discoveries made by him as soon as possible, and Henderson at once advised Carmack of the discovery on Gold Bottom and advised him to try there. Making inquiries of the local Indians as to the situation of Gold Bottom, Carmack learned the route to it, and along with the two Indians mentioned, started climbing over the ridge which divides the valley of the Yukon from the valley of Bonanza Creek, down into that creek and up it to El Dorado. He went up it about three miles and then followed the ridge dividing its waters from those of Bonanza until he struck the watershed between Indian Creek and Klondike, along which he traveled until he reached the head of the creek that he assumed to be the Gold Bottom. He went down, found Swanson and Munson at work, but was not satisfied with the prospects there, and determined to return and prospect the creek now known as Bonanza from its head downward, as it lay in the direction of his way home.

STRIKING IT RICH ON BONANZA.

He found nothing of note until he came down about midway, where from a little nook in a bend of the creek he panned out a good prospect. This encouraged him to try again. He did so, and in a few moments panned out $12.75, which he put in an old cartridge shell and corked with a piece of stick. This was on August 10, 1896. The next day he staked discovery claim and No. 1 below for himself, No. 2 for Tagish Charlie and No. 1 above for Tagish Jim. He then made his way down the creek as fast as possible and went down the river for a supply of provisions.

On the way he met several miners and informed them of his discovery. At first they would not believe him, as his reputation for truth was not above par. These miners said they could not tell when he was telling the truth, if he ever was, as he was the greatest liar this side of—a great many places. Some of them came to me and asked my opinion. I pointed out to them that there was no question about the man having the $12.75 in gold. The only question then, was, where did he get it? He had not been up the Sixty Mile, nor yet the Forty Mile, and he must have got it somewhere near where he was engaged fishing, and that was right at the mouth of the Klondike.

EXCITEMENT BEGINS.

Then followed the excitement. Boatload after boatload of men went up from Forty Mile. They went up anyhow and anyway, starting at all times of the day and night. Men who had been drunk for weeks and weeks, in fact, were tumbled into the boats and taken up without any knowledge that they were travelers. One man, indeed, was so drunk that he did not realize that he had left Forty Mile until he was more than two-thirds of the way to the Klondike. And yet he owns one of the very best claims in the Klondike district to-day.

The whole creek, a distance of about twenty miles, giving in the neighborhood of 200 claims, was staked in a few weeks. El Dorado Creek, seven and a half or eight miles long, providing eighty claims, was staked in about the same length of time. Bowlder, Adams, and other gulches were prospected, and gave good surface showings, gold being found in the gravel in the creeks. Good surface prospects may be taken as an indication of the existence of very fair bedrock.

It was not until December, however, that the character of the diggings was established. Twenty-one, above Discovery, on Bonanza, was the one which first proved the value of the district. The owner of this claim was in the habit of cleaning up a few tubfuls of dirt every night, and paying his workmen $1.50 an hour.

HOMESTAKES NUMEROUS.

Bonanza and El Dorado creeks afford between them 278 claims; their several affluents will yield as many more, and nearly all of these claims are good. I have no hesitation in saying that about a hundred of those on Bonanza will yield upward of $30,000,000, and about thirty on the El Dorado will yield $1,000,000 each. These two creeks will, I am quite confident, turn out from $60,000,000 to $75,000,000, and I can safely say that there is no other region in the world that has afforded so many homestakes—that is, fortunes enabling the owners to go home and enjoy the remainder of their days at their ease—considering that the work has had to be done with very limited facilities, the scarcity of provisions and of labor, and that only the crudest appliances are as yet available. When I tell you that to work properly each claim ten or twelve men are required, and that only 500 were available that season, it will give you an idea of the difficulties which had to be contended with.

On Bear Creek, which joins the Klondike about seven or eight miles above that, good claims have been found; and also on Gold Bottom, Hunker, Last Chance and Cripple Creeks. On Gold Bottom, as high as $15 to the pan has been taken, and although we cannot say that they are as rich as El Dorado or as Bonanza, they are richer than any other creeks known in that country. Then, thirty-five miles higher up the Klondike, Too-Much-Gold Creek was found. It got its name from the fact that the Indians who saw mica glittering in its sand mistook it for gold and so named it.

THE WORLD'S RICHEST GOLD FIELD.

A fact that I am now going to state to you, and one easily demonstrated, is that from Telegraph Creek northward to the boundary line we have in the Dominion and in this province an area of from 550 to 600 miles in length and from 100 to 150 miles in width, over the whole of which rich prospects have been found. We must have from 90,000 to 100,000 square miles, which with proper care, judicious handling and improved facilities for the transportation of food and utensils, will be the largest, as it is probably the richest, gold field the world has ever known. The British Columbia Minister of Mines may wish to extend that down to the boundary line, but that of course I leave to him.

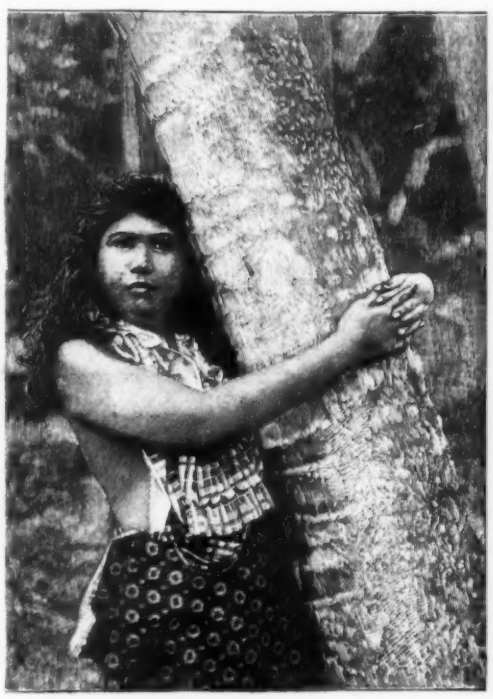
The Stewart and the Pelley rivers are in this gold-bearing zone, and also give promising indications. As I, before mentioned, the Stewart River had been mined for several years before the discovery of gold on Forty Mile. After that discovery Forty Mile took the attention of all the miners covering the country until the discovery of gold on Birch Creek. The Forty Mile district, together with the Birch Creek district, engaged all the transportation facilities of the two companies trading on the river, and there were no provisions to spare for any other than these two points.

This prohibited prospecting on the Stewart or elsewhere, but many of the old timers declared, and do so yet, that with a proper supply of provisions placed convenient to the Stewart it will be the camp of the country, as, with its affluents, aggregating about 800 miles of stream on the bars of Stewart River, year after year grub stakes have been cleaned up, the supply being replaced annually. It is now easy to make $8 a day off those bars, and the discoverers for several years made $20 a day and upward. It is obvious from the yearly renewal of this gold that it must come from somewhere. That somewhere has not yet been found. Give us facilities, and a very short time will settle the question. The Stewart itself, it is argued by those who ought to know well, is navigable for a distance of about 150 miles from its mouth. This in itself is a valuable asset in the development of that district.

Robert Henderson, to whom I referred as leading up to the discovery of gold on Bonanza, in June of the past year started up the Stewart alone in a small boat with a supply of provisions and tools to prospect on the river and its branches, being convinced that it offered the largest and probably the richest field in that country for prospecting. That is the stuff the true prospector is made of, and I am proud to say that he is a Canadian.

AS TO QUARTZ CLAIMS.

Seven quartz claims have been located already in the vicinity of Forty Mile and Dawson. One of these, named Cope Hill, about two and a half miles up Forty Mile River from the Yukon, is a veritable mountain of gold-bearing rock and would require generations to work out. Assays show from $3 to $11 per ton. The only question is, Will that amount pay for reduction under the conditions there existent and the enormous



INDIAN GIRL OF ALASKA.

freight rates incidental to transportation to that vicinity? About forty miles further up the river two large claims have been located by an expert miner hailing from the United States, who has had considerable experience in Montana and other mineral States, and he assured me that the extent of the lode on which these two claims are situated is such that it is greater than anything else in the world, his assays showing the value to be about $8 a ton.

On Bear Creek a quartz claim was located last winter and I drew up the papers for the owner. He had to swear that he had found gold, but he would not tell me what it was. I pounded up several specimens of the rock in a hand mortar, but had no sieve to complete the operation properly. Those who understand this will infer at once the difficulties I had to contend with. The poorest specimen I tried yielded $100 to the ton; the richest, $1,000.

Now, while I am positive of this, I know nothing of the extent of the lode. The discoverer described it to me as being about 30 feet high and 15 feet wide, projecting into the bed of the creek, but whether it was the lode itself or simply the result of a slide he did not know. Even if it is the latter, it would not be a very difficult feat to find the lode from which it was detached. About thirty miles up the Klondike another quartz claim has been located by a Canadian, who swore positively that he found gold in it, and that it was good, but he did not say just how good.

AFTER THE MOTHER LODE.

A point to which I now want to direct attention is that the gold on Bonanza and El Dorado Creeks at certain stages has the same degree of fineness. As you come down both creeks it decreases in value until it reaches a minimum of about $15.25 per ounce, troy weight. From that point it again increases as we go further down. Now, if we draw a line through the points of corresponding value on these two creeks, we find that, projecting them eastward, we strike Gold Bottom and Hunker creeks. Projecting them west, we strike Miller and Glacier creeks and the heads of the various gulches in Forty Mile, from fifty to sixty miles away. What do we infer from this? That there is a continuous system of gold-bearing rock running across the country in this direction.

Again we find that the gold in nuggets found on Bonanza and El Dorado bears no evidence of having traveled any distance—in fact, the majority of the nuggets are as angular and irregular in shape as though you had just pounded them out of the mother lode. This, I think, leads to the inference that that mother lode is not very distant from where this gold is now found, and the only debatable question in my mind is, Is it in lodes of sufficient dimensions to pay for working by stamp mills, or is it a series of widely disseminated, thin seams that the miners term "stringers," so scattered as to render working them unprofitable? Time alone will reveal this secret.

I have been told that gold has been found at the head of Lake Lebarge on a stream flowing into the lake from the east. Prospects, too, are found on the Dalton trail on the other side of the Yukon River.

From these circumstances and discoveries it may be assumed that in all this country there is gold, while in this particular zone it is especially abundant. This zone lies outside of a range of mountains which extends to the westward of the Rockies and has the same general trend. It consists of cretaceous rock, rising into very high peaks in some places, and crosses the Yukon River just below the boundary.

DIFFICULTIES OF PROSPECTING.

Passing down the river in a boat one sees a succession of trees, ten, twelve, fourteen and sixteen inches in diameter, and he naturally comes to the conclusion that it is a well-timbered country, and so it is—along the margin of the river. But let him disembark and go inland, and he will find the ground covered with what are locally known as "niggerheads," which consist of columns of decayed coarse grass peculiar to this region. They are formed by the annual growths of grasses decaying and falling down, while year after year the roots of the growing grasses bind this together into an almost solid column, which stands upon a bed of mud. To walk across a niggerhead swamp is one of the most fatiguing exercises one can take. You cannot walk on them—you must walk between them. Put your foot on top of one of them—it sways under you and down you go to your knees in the mud between them. The result is that the miners and other residents of that country keep as far away from the niggerhead swamp as they conveniently can, avoiding it as they would the plague.

For the rest of the country the surface is covered by from one foot to two of moss, and, underneath, the everlasting frost. On this a scrubby growth of trees is found extending up the mountain sides to an altitude of from 1,000 to 1,500 feet above the river. It is this which appears to those passing down the river in boats to be a continuation of the good timber seen along the banks. Timber that is fit for anything is scarce, and we should husband it carefully. A great deal of our timber has already gone down the river. It was our timber that built Circle City. Our timber has indeed served all the purposes of the Upper Yukon country. A large amount of timber is required for the development of our own resources on the upper river, and our government should at once take steps to protect it for our own use and benefit.

Above the timber line you come to the bare rocks—the crests bare save where clothed with a growth of lichen on which the cariboo feeds. There is no timber in the way here, no moss and no brush. The miners consequently keep as much as possible to the top of the ridge.

GETTING TO BED ROCK.

Bed rock prospecting necessarily has to be reserved for the winter. First the moss has to be cleared away, and then the muck or decayed vegetable mould has to be picked away for a depth of two or three feet. After two or three feet in depth has been picked out, a fire is built in this "hole," as it is termed, in the evening. In the morning the ground which has been thawed by the fire is shoveled out and in the afternoon wood for another fire is procured; in the evening another fire is built, the ground thawed by this is shoveled out the following morning, and so on until bed rock is reached.

Six, eight, ten and twelve feet of the surface is decayed vegetable matter and alluvial deposit of sand in the clay, termed by the miners "muck." As soon as gravel is struck, prospecting is commenced; that is, a pan or two of the dirt is washed to determine whether it is worth "keeping" or not, as the refuse is thrown on one side of the hole and the pay dirt on the other. Near to and on bed rock the pay is found, which is generally not more than two or three feet deep.

GETTING OUT THE DIRT.

Now, a few words on the manner of getting out the dirt in this region. As soon as the ground is frozen sufficiently to enable us to prosecute our work without interference from water, we sink a hole to bed rock, as I have before described. The time this takes is measured by the depth of the hole, one foot per day being counted fair work. Should we reach bed rock without finding prospects, another hole has to be sunk in the same way, and this process continued until the pay is struck.

One claim holder may locate pay at the very first hole. The man adjoining may have to sink many. I know of one instance in which eleven holes were sunk across the valley without anything being struck in any of them. In fact, the valley was almost crosscut, as it is termed, yet a miner in the vicinity paid this unfortunate man $2,500 for a half interest in his claim, being well aware of the fact that eleven holes had been put down and nothing found. This, I think, gives one an idea of the confidence the miners have in the ground on those creeks.

Now, suppose pay is struck is struck in one of the holes. The pay streak, as I have said before, is seldom more than three feet in depth. On the side of the hole which shows the best indications a fire is placed, which thaws out a few inches on that wall. In the morning the waste dirt, or what contains no pay, is shoveled out and thrown to one side, the pay dirt being placed in what is termed the dump, which freezes solid soon after it has reached top. This process is continued in the direction of the best pay, a distance which is governed by the thickness of the crust on top. If this is twenty feet, you may drift thirty feet with safety.

when a new hole or shaft has to be sunk and the drifting continued.

In this way the pay streak is taken from underneath the surface in winter until the water begins running in the spring, finds its way into the shafts, and hinders operations to such an extent that they are closed. Preparations for the erection of dams are then made and sluice boxes procured with which to wash the dump.

SLUICING.

A sluice box is about ten inches in width and twelve feet in length, the boxes so made that they fit into each other like the joints of a telescope. In these are placed what are called riffle bars, which are strips of wood about one inch square and eight or ten feet long, nailed together at their ends so as to be parallel with each other, and about one-half to three-quarters of an inch apart. These are placed longitudinally in the sluice boxes, which are set up so as to have an incline of two or three inches fall per foot of their length. Into this system of boxes a stream of water is directed, which must be of sufficient volume to carry with it the gravel and dirt that are in the dump.

As soon as the sun has attained sufficient force to thaw out the surface of the dump it is shoveled into these sluice boxes. The water carries down with it to the tailings, as it is termed, the refuse—that is, the gravel, sand, and other matter which is not wanted. The gold and the black sand, which is simply pulverized magnetic ore, owing to their much greater weight, fall between the riffle bars and are held there.

THE CLEAN-UP.

As soon as the riffle bars are filled, so that there is danger of the gold passing over and downward to the tailings, the flow of water is stopped, and what is called the clean-up is made; that is, the riffle bars are lifted out and the contents of the sluice boxes gathered and the black sand and other refuse separated.

In one instance eighty avoirdupois pounds of gold were realized from a single clean-up, representing about $16,000 in money. This seems extraordinary, but we must bear in mind that the dump from which this came contained only $110,000 and took the united efforts of five or six men at $1.50 per hour for upward of three months, not including the labor of sluicing, so that, although it is tremendously rich, it is not exactly all profit.

MOSQUITOES AND TEMPERATURE.

First a few words about the mosquitoes. During the summer and until September they are a veritable plague. They seem to feed on smoke, and as to fire, they appear to revel in it. The only way to escape them is to cover one's self with mosquito netting. Indeed, it is impossible to prospect in the summer time unless a man be an old miner and well hardened, for all day long and twenty-four hours in the day those mosquitoes are after you. It is no use trying to get rid of them. Of course they are not an annoyance in the winter time, but, although we have no mosquitoes then, I will show you, on the other hand, what you may expect in the way of temperature. I have made some extracts from my meteorological records, which I will here present. They cover the period from August, 1895, to November, 1896, and show the highest and lowest temperatures reached, as follows:

1896.

January.	0 and above, 1 time
	—30 and below, 23 times
	—40 and below, 15 times
	—50 and below, 12 times
	—60 and below, 7 times

Lowest, 26th, —68·5°; highest, 29th, 6°. Mean maximum temperature, —42°; maximum temperature, —33°. Snowed on four days.

February.....	0 and below, 28 times
	—30 and below, 11 times
	—40 and below, 10 times
	—50 and below, 2 times
	—60 and below, 2 times

Lowest, —64·5°; highest, 20th, 32°. —32° and above, 7 times.

NO NATURAL FOOD PRODUCTS.

The natural products of the country as a food supply may be said to be valueless when compared with the demand which will soon exist for it there. It might, indeed, be said that all food will have to be imported. In the river are some small fish resembling the grayling, and the salmon annually make their way up as far as the cañon, some 2,000 miles from the sea. But long ere they reach that point they are pretty well spent.

The only timber in the country that is fit for mercantile purposes is spruce. There are a few poplars, which, however, are generally unfit for anything except fuel. The spruce is soft, weak, and full of knots.

LAW-ABIDING PEOPLE.

I came a good deal in contact with those men during my work about the creeks, settled many of the disputes arising between them, adjusted many differences—and everywhere and every time they had the highest respect for the law. Never but once was anything unkind or uncomplimentary said about what was done, and in that case the offender soon after offered a most ample apology. I think I can safely assert that, taken as a whole, there is no more lawlessness or disorder in the minds of the miners of that district than there is in the minds of the citizens of our most highly civilized communities in this favored land.

In conclusion let me say that we have in the far northland a vast region comprising from 90,000 to 100,000 square miles of untold possibilities. Rich deposits we know exist in it, and for aught we know many more equally rich may yet be found. We know now that there is sufficient to supply a population of a hundred thousand people, and I look forward to seeing that number in that country within the next ten years.

WILLIAM OGILVIE.

Our engravings, for which we are indebted to the Illustrirte Zeitung, give some interesting views of the Klondike region and of Alaska.

Juneau, on Lynn Channel, is one of the largest places in Alaska, a city that has grown very rapidly, and now has about 9,000 inhabitants. Here the gold seekers usually rest before starting on their journey into the interior. Opposite the city, on Douglas Island, is the Treadwell mine, the largest gold mine in the world, which realizes a net profit of $70,000 to $80,000 per month.

The first nugget found in the Yukon Valley fell into the hands of a German named Konrad Dahl, on March 26, 1894, in Franklin Gulch. It weighed 30 ounces, and after it had been smelted in the mint at San Francisco, weighed 29·45 ounces, with a value of $491.45. It is shown in our engraving.

The native Indian girl is in the costume of the country.

CASTANOPSIS CHRYSOPHYLLA.

THIS plant was procured from Messrs. Veitch about 1854–56. On applying lately to them for a precise date, they were unable to trace it; they think, however, that their collector, Lobb, may have sent its seeds to them about 1853. In the winter of 1879 it was 20 feet high, with a girth of 17 inches at 3 feet from the ground. At the present moment it is 27 feet high, with a girth of 36½ inches at 3 feet from the ground. The increase in diameter at this point is, therefore, about one-third of an inch annually. The first branch is at 6 feet from the ground. The tree is in perfect health, and seems to be free from all insect enemies. Up to 1882 it bore sterile "burrs," miniatures of those of Castanea vesca; but since that date it has produced good seed. About half a pint of these small chestnuts, each no bigger than a small pea, has been collected every autumn, and many healthy plants have been reared in spite of a considerable mortality during the first three years after germination. Several healthy specimens over 6 feet high have been planted out in the neighborhood of the parent tree, or have been distributed among friends. One of these in the grounds of Sir Joseph Hooker at Sunningdale is now 10 feet high.

The experience of forty years has shown that Castanea chrysophylla is hardy here. It stands on a hillside of old red sandstone on a southern slope of sand and loam, sheltered from the north and east by rising ground, and protected against the prevailing south-west wind by a grove of larger trees.

Before the publication of vol. ix of "The North American Sylva," by Prof. Sargent in 1896, the references to this tree in botanical works were meager and incomplete. Prof. Sargent describes it as follows: "A tree from 100 to 150 feet in height, with a massive trunk from 5 to 10 feet in diameter, and frequently free of branches for 80 feet above ground. . . . A small tree in Oregon and on the Californian sierras, and usually shrubby at high elevations and on the Californian coast ranges south of the Bay of San Francisco. The golden-leaved chestnut attains its greatest size and beauty in the humid climate of the coast valleys of Northern California, where, scattered among coniferous trees, it is one of the noblest and most beautiful inhabitants of the forest, with its fluted columnar trunk and brilliant leaves, bright green and lustrous on the upper surface, and golden-yellow on the lower."

This golden-yellow color on the lower side of the leaves becomes very conspicuous when the branches are moved by the wind. Although the Tortworth specimen is never likely to attain the size recorded by Prof. Sargent, its present healthy condition and uninterrupted growth seem to promise a tree of the fourth or fifth magnitude in the course of the next half century.

In his description of the genus, Prof. Sargent writes: "Of Castanopsis, which is intermediate in its character between the oak and the chestnut, about twenty-five species are now recognized; one inhabits the forests of Pacific North America, and the others Southeastern Asia, where they are distributed from Southern China through Malaya to the Eastern Himalayas." In all the species the leaves are persistent. It is a pleasure to me to have found a record of Dr. Asa Gray having examined my tree when on a visit here, January 11, 1881. Ducie, Tortworth, Gloucestershire, November 12.—The Gardeners' Chronicle.

CASTANOPSIS CHRYSOPHYLLA—HARDY TREE: FLOWERS AND FRUITS.

(From a specimen sent by the Earl of Ducie.)

BACTERIOLOGY IN 1897.

IN bacteriology a number of researches have been devoted to the bacillus of bubonic plague. Yersin has announced considerable success in the treatment of the disease with his antitoxic serum, but independent observers on the spot are somewhat skeptical of the results obtained.

Haffkine and Lustig and Galeotti have devised vaccines prepared with cultures of the bacillus (Brit. Med. Journ., 1897). Haffkine has also drawn attention to curious stalactite down growths occurring in broth cultures of the bacillus (Brit. Med. Journ., i, 1897, p. 1461), and Hankin has observed large swollen involution forms when the organism is grown on a salt agar (Centr. f. Bak., xxii, 1897). Hankin and Nutall suggest the possible spread of the disease by insects and animals, such as rats and monkeys (ib.) Three suspicious cases occurred in London the latter part of last year (Loc. Gov. Board Rep., 1896–97), and in one the plague bacillus was undoubtedly isolated by Hewlett (ib. and Trans. Brit. Inst. of Prev. Med., i, 1897). In these cases Buchanan ascribes the source of infection to articles of clothing.

The spread of the rinderpest at the Cape has also occasioned considerable attention to be paid to this disease. So far no organism has been isolated, but means of prevention have been devised by Koch and his co-workers by the use of the bile of affected animals and of the serum of "salted" ones, i. e., beasts which have recovered from an attack. Incidentally it may be not out of place to remark that while German and French commissions are investigating rinderpest, and German, Austrian, Italian, French and American bacteriologists are studying plague, the British government has remained completely inactive, not a single British bacteriologist having been deputed to investigate either of these scourges!

In diphtheria there is not much of importance to record. Diphtheria antitoxin has maintained its position as the most valuable remedy in the disease. Neisser has found that the diphtheria bacillus produces little or no acid during the first nine hours; after that, up to the end of the first twenty-four hours, a considerable quantity is formed, which increases somewhat until the end of the second day, when it ceases. The same observer has devised a double stain for the bacillus, which, he states, is almost diagnostic (Zeitschr. f. Hyg., xxiv, 1897, p. 443).

The Widal reaction for enteric fever is still considered to be one of the most reliable tests. It is recognized, however, that the dilution should not be less than one in ten, and a time limit of half an hour or so must be adopted. Foreign substances must be excluded, for Malvoz has found that corrosive sublimate, alcohol, salicylic acid, and safranin cause agglutination of the typhoid bacillus. Safranin agglutinates the typhoid bacillus but not the colon bacillus (Ann. de l'Inst. Pasteur, xi, 1897, p. 582).

Copeman and Blaxall have published a paper on the influence of glycerin, etc., on the growth of organisms in vaccine lymph, showing that glycerinated lymph after storage becomes sterile, though still retaining its vaccinating properties unimpaired (Report of the Medical Officer of the Local Government Board, 1895–96). In the same volume Klein reports his examination of a number of cases of suspected cholera with negative results. In the succeeding volume (1896–97) Klein details the characters of the bacillus of bubonic plague, with experiments on immunization. He also describes the characters of Copeman's variola bacillus. In both these volumes a good deal of space is devoted to vaccine establishments and forms of vaccination and lymphs.

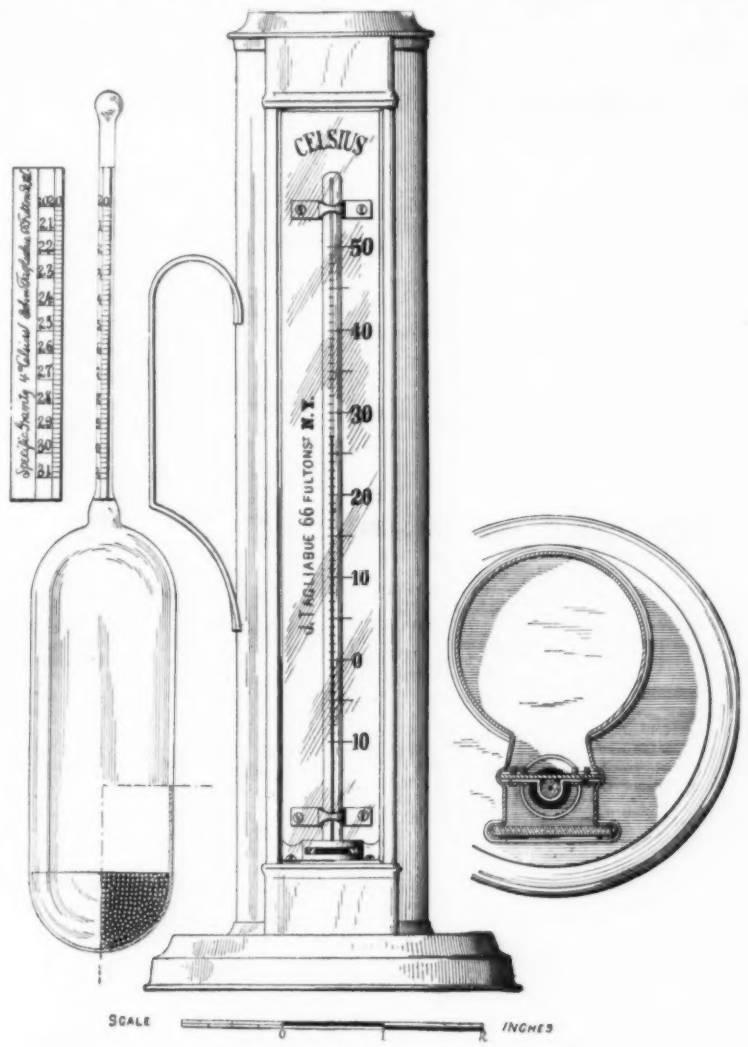
Sanarelli has discovered a bacillus which he believes to be the cause of yellow fever. It is a small organism, forming on gelatin bright opaque drops, like droplets of milk, without liquefaction. It stains by Gram's method, but is difficult to demonstrate in the tissues (Il Policlinico, Brit. Med. Journ., and Ann. de l'Inst. Pasteur, 1897). Sternberg claims that this organism

described by Sanarelli is identical with his bacillus X, obtained in 1889 (Centr. f. Bak., xxii, 1897, p. 145).

The epidemic of beri-beri in Dublin has spread, and more than 100 cases have occurred. In two cases of this disease Hunter has isolated a coccus apparently identical with that described by Pekelharing and Winkler (Lancet, 1897, ii, p. 240).—Pharm. Jour.

THE UNITED STATES FISH COMMISSION SALINOMETER.

WE present an engraving of the salinometer as used by the United States Commission of Fish and Fisheries. It is used for determining the temperature and the density of sea waters. It consists of a glass float with a long stem and a large bulb weighted so as to sink in fresh water to a point near the top of the stem. The stem is graduated to read between 1·000 and 1·031 the figures representing the specific gravity, that is for showing the weight of the salt water, an equal body of fresh water being supposed to weigh 1·000. In practice a scale having the entire range would be too long for safety and convenience, and therefore the salinometers are made in sets of three, reading from 1·000 to 1·011, from 1·010 to 1·021 and from 1·020 to 1·031 respectively. There was also provided with them a deep copper cup or cylinder, at one side of which a thermometer is attached. The method of using the salinometer is as follows: The cup is filled with the water to be tested, the appropriate float is placed in the water, the density of which will be the reading of the scale nearest the point where the surface of



SALINOMETER AND SALINOMETER CUP.

the water touches the stem. For purposes of oyster culture the finer graduations may be neglected. To show the specific gravity the number "1·0" should always be placed in front of the scale reading. For example, if the surface of the water should stand opposite the scale reading "15," the density would be 1·015. The test should be made immediately after the water specimen has been collected and a reading of the thermometer should be taken at the same time. For practical purposes on the oyster beds a bottle or jar not less than ten inches deep may be used instead of the copper cup and any ordinary thermometer may be used for obtaining the temperature. The cheap wooden-cased instruments known as "bath thermometers" serve very well, as they have no metal parts to be corroded by the salt. In most oyster regions the salinometer reading from 1·020 to 1·031 will not be necessary, as the density on the oyster beds rarely fall within its range. The specimens of the water should be taken from the bottom, or near it, and may be conveniently obtained from the following rough method: An empty jug or large bottle weighted and corked is lowered to the bottom by means of a line. The cork is then pulled out by jerking on a cord previously attached to it. The receptacle fills with a sample of the water from or near the bottom, and, if hauled rapidly to the surface, it answers practically the same scientific and accurate purposes.

It has been shown by experiment that the heating of oxides formed from incandescent mantles even in oxygen produces no light, so that the incandescence of the mantles must be due partly to chemical action.—Zeitschrift für Architectur.

A REVIEW OF AMERICAN ELECTRICAL PROGRESS DURING THE YEAR 1897.

THE twelve months just passed have been distinguished by no very startling or radical innovations or discoveries in the electrical field, but rather marked by a steady advance along all lines. Applications of electrical power and the general utilizations of this agency have multiplied, and a gratifying enlargement of the capital invested, both in manufacturing electrical apparatus and in the generation of current, may be noted.

Prominent among the purely scientific discoveries of the year is that of Dr. Zeeman concerning the remarkable and beautiful phenomenon of the widening of the spectral lines of incandescent gases when the source of luminosity is in a strong magnetic field. Knowledge of Roentgen rays, cathode rays and the other phenomena of vacuum tubes has increased somewhat, and the power and convenience of instruments for the generation of X rays has been greatly bettered. The induction coil and static influence machine have both undergone great improvement as the result of the wide interest in vacuum tube phenomena and the demand for instruments of higher power.

In the generation of electricity by the direct consumption of carbon little or no advance seems to have been made. The parade of newspaper announcements heralding the advent of direct heat generation methods has passed, and the subject seems, for the moment, to have ceased to attract investigators.

In practical engineering there have been several marked features of advance. The long distance transmission of water power has been the field for many interesting developments, and the colossal installations erected during the year have exhibited the highest class of engineering skill and not infrequently of capitalistic daring. The increasing use of multiphase currents and the continual improvement in machinery for their generation and utilization has shown the direction of the evolution of central station and power transmission engineering, while their application to railway work is strongly foreshadowed.

In electric traction increasing attention has been given to the equipment of heavy railways, principally for suburban traffic and of those working under exceptional conditions, such as elevated roads. The experiments of the New York, New Haven and Hartford Railway Company, near Hartford, have been an encouragement to the railway companies, while the equipment of roads intermediate in class between the ordinary city trolley line and the heavy railroad has progressed continuously. The adoption of an open conduit system by the street railways of New York City and the success which has attended their opening for traffic are important factors of the year's advance in electric traction.

The electric automobile has taken its place as a commercial and practical machine, and electric cabs and vehicles no longer attract attention in the streets of New York.

In electric lighting the principal advances have been in the increasing use of high voltage lamps and the substitution of rotary transformer substation systems for the multistation low pressure installations which have for many years illuminated our principal cities. In many new installations lamps for 220 volts or even higher pressures have come into use, while numerous installations have changed over from the old standard pressure of 110 volts to the new.

The inclosed arc lamp has increased its applications prodigiously, and seems to bid fair to displace the open arc form in many places. It has of late been used, burning on constant potential circuits, for street lighting with excellent results and it is confidently expected that the alternating current types of such lamps, which have been perfected during the year, will soon be as widely used as those for direct current.

In telephony the advance has been confined to details of exchange systems rather than to radical improvements of apparatus. The independent companies have grown in strength, and their association formed during the past summer promises to play an important part in telephone affairs in the future.

Telegraphy has not greatly advanced. There are promising indications that processes of machine telegraphy will shortly be brought to greater perfection, and that they will then largely supersede the present manual systems. Some new submarine cables have been laid and plans formulated for a Pacific cable, which will be the last link in the electric girdle of the earth.

The electric elevator has taken its place as the standard machine, having been almost universally installed in new buildings, and in many cases taking the place of hydraulic elevators.

In other applications the great adaptability of the electric motor has been prominently shown. It is coming to be used more and more for the direct driving of many kinds of machinery, notably printing presses and machine tools, and the manifold advantages of electric power transmission over the time-honored method of belts and shafting have become so well understood that few large new factory installations are considered complete without an electrical system of machine driving.

The accumulator has not materially changed during the year, few new types having been exploited, but its use has been greatly extended, both for electric light and railway purposes. In this respect American engineering has been somewhat backward, the merits of the accumulator having received a substantial recognition in Europe for several years. There has been but one revival of an attempt to operate accumulator cars, it being generally considered that past experience with them has promised little to future experimenters.

The alternating current motor has been greatly developed. Many experimenters and designers are diligently at work on the problems connected with their use, especially in railway work—a most promising field for them. New methods of control and operation have been devised, many of them of the greatest originality. The general expansion of alternating current work in all directions is well shown by the interest evinced on all sides in polyphase motors.

Transformers of the stationary type have been made larger and better than ever before, and their internal losses reduced by careful proportioning and design.

The general trend of discussion has brought out a few noteworthy indications of the tendency of future progress. The perfection of alternating current apparatus has made much of the direct current machinery now in operation old fashioned, and the tendency in this direction seems to be for the superseding of the older forms by the more flexible and satisfactory multiphase systems. The rotary converter has been brought to great perfection and in such installations provides the direct current where this is necessary.

Looking at the future of the electric railway, it is seen that all indications point to the suppression of the steam locomotive for suburban and interurban work in favor of the electric train. Already several railways having large suburban systems are making experiments and preparing for the inevitable change in motive power.

The experiments in electric transmission between the engine and running gear of locomotives should not be overlooked, and the appearance of some promising hybrid types of gas engine electric locomotives is also noteworthy.

Certain long promised improvements in other departments seem to be progressing slowly. "Cold light" has not yet become a commercial possibility, though some very interesting public experiments have been made. The limits of long distance power transmission seem to be now set at about 80 miles—and this in a dry climate. The telephone repeater remains as a source of inspiration for determined, but so far unsuccessful, inventors.

Perhaps the most popular demonstrations during the year have been those made by the advocates of wireless telegraphy, largely owing to the prominence given to the well known Hertz waves by Mr. Marconi. This seems to have, in a measure, captivated public fancy, but so far no very practical results have been attained nor has the advance been commensurate with the interest it has elicited.

The steam turbine as a possible and probable factor in the development of the electric arts deserves notice as the most promising method of developing the motive power of steam at present known.

It may be said, in conclusion, that the progress of the electric arts in America during 1897 has been very gratifying. Electrical engineering has advanced beyond the stage when revolutionary departures are the rule, and has reached the level of successful adaptation to the demands of necessity. Its growth and extension therefore must now be marked rather by the steady betterment of its means and methods, the gradual enlargement of its field of labor, the deeper identification with the advance of civilization, than by brilliant and revolutionary change. Here, at the beginning of a new year, it is pleasant to look back and see that in no single department of the vast field of the electric arts has there been any retrogression, but in all that sure and steady improvement that is the sign of maturity and full development.—The Electrical World.

At Barcelona (Italy) a peculiar phenomenon was recently observed. The sea level rose and fell by more than a yard at intervals of ten minutes, the whole period of rise and fall occupying twenty minutes. A similar tide was noticed during the earthquake at Krakatoa.—La Vie Scientifique.

ENGINEERING NOTES.

Southampton is now ready for attack by sea, the five gunboats that carry the defense boom having been placed in their stations. The boom consists of a network of wire hawsers running from ship to ship and connected with heavy balks of spiked timber and to submarine mines.

The extent of American exports is well shown by a paragraph in a recent issue of The American Machinist, which says: On a trolley line in Birmingham, England, the rails are made in Pittsburg, the cars in Philadelphia, the boilers in Erie, the engines in Milwaukee, and the electric fittings in Schenectady.

It took seventy shots at close range, including a number from the 9·2-inch caliber gun, before the British cruiser "Edgar" could sink a dereliet tank steamer in the Red Sea. Naval men are trying to figure out how many shots would have been needed if the "Edgar" had been dealing with a hostile cruiser of her own class.

A comprehensive tubular dispatch system for Brooklyn, N. Y., is being talked of, says Engineering News. This contemplates tubes running from Coney Island, Rockaway Beach, Jamaica, Bensonhurst, Flushing, Flatbush, East New York and other places to the post office in Brooklyn. It is even suggested that a station be located on the Narrows, opposite Quarantine, from which all incoming first class matter could be sent at once to the Brooklyn post office. It is hoped to have the tube across the Brooklyn Bridge in operation inside of thirty days.

The manufacture of steel tea chests is about to be carried on by a Glasgow firm, says an exchange. When the works are in full operation, the production is expected to approach 1,200,000 tea chests per annum. The preparation of the plates is an interesting process, and simplicity characterizes the whole invention. The top and bottom are of wood, lined with thin metal. The whole surface of the chest inside and out is coated with a solution of lead and tin. After being pickled in acid and washed the sheets are passed through an ingenious machine, which performs coating automatically. The sheets are then trimmed to gage by guillotine machines and then taken to the large press, which at one stroke practically makes the body of the chest.

The largest plate mill rolls ever cast in Scotland have recently been successfully turned out by Mr. R. B. Tennent, of the Whifflet Foundry, Coatbridge, says Engineering Mechanics. They are "grain" rolls, and are for a firm in England engaged in the manufacture of steel boiler plates. For the casting of each roll fully 40 tons of molten metal were required, the metal being run into the mould from three ladles simultaneously. The time occupied in this highly responsible work was under three minutes, and was performed in each case without a hitch. The rolls are of a total length of 19 feet ¼ inch, 42 inches in diameter, and 13 feet 6 inches in length of finished body. The finished weight will be about 33 tons, 10 tons heavier, it is believed, than any roll in use in Scotland.

Commenting on shipbuilding in Great Britain during 1897, The London Iron and Coal Trades Review says: "Local returns of shipbuilding in 1897, so far as they have appeared, make it quite evident that the record for that year will be considerably behind that of 1896, which, however, exceeded that of any previous year. Belfast, for example, launched in 1897 some twenty-one vessels, with a tonnage of 108,863, or 10,000 less than the tonnage of the previous year. On the Humber, again, there was launched in 1897 only 4,781 tons, against 13,428 tons in the previous year. Many of the leading shipbuilders have been unable to complete their contracts, and some of them have lost as much as five months' work owing to the engineering strike. It will not be surprising if, when the returns for the year are made up, it turns out that 1897 is 250,000 or 300,000 tons behind the previous year."

The Railway Age, of Chicago, makes the following statement regarding new railway lines built in the United States in 1897: While the year 1897 has shown larger railway earnings and better business conditions than its immediate predecessors, the marked improvement in the financial outlook did not begin early enough in the year for the completion of many new railway undertakings, and so it now appears that, although much construction work is under way, the mileage of track actually laid is but little greater than that for the preceding year. The lowest point in 20 years in respect to railway building was reached in 1895, when only 1,803 miles of track were added, and 1897 has done a little better, the total now reported to us being 1,864 miles. California stands first, with 210 miles laid on different roads, and no track was laid in New Hampshire, Rhode Island, Connecticut, Maryland, Kansas, Nebraska, New Mexico, Indian Territory, Arizona, Wyoming and Nevada, and five others barely escaped from this category. At the commencement of 1898 the United States will have 184,464 miles of completed railway.

The felt mats for rails which the Adlerhof Felt Works, near Berlin, exhibited at Leipzig last summer, are not intended to protect the rails against catching cold, but to protect the public from the noise and clatter of the traffic on street railways. They are especially recommended for crossings and bridges, but would be a boon everywhere along the track, and it may be that they really spare the rails, as the manufacturers claim. The mats are made of strong wool, which is thoroughly impregnated with oils, then superficially coated with glue, which has been rendered insoluble by the addition of sodium bichromate and formaldehyde, and then very highly compressed as to form plates from a third of an inch to several inches in thickness and of various sizes. The surface is said to be so hard, and yet elastic, that a rail may be placed on such a piece of matting without cutting into it. If the noise of engine rooms and workshops can be reduced by placing the mats under the bed plates, bearings between the joists, etc., people would probably neither mind the absurd name, iron felt, nor the possibly not too moderate price. But engineers will, perhaps, prefer to wait till they can ascertain how long the felt will keep its elasticity. The preparation prevents rotting.

ELECTRICAL NOTES.

The annual charge of $37.50 for telephone service in Berlin will in future be replaced by a yearly rent of $12.50 for the apparatus plus the small charge of one pfennig (about one-fourth of a cent) for each conversation by private persons, two pfennige for business men and firms and three for clubs, cafés, etc. Business men are strenuously opposed to the proposal that they be charged more than any others.

Our contemporary L'Eclairage Electrique states that 28,000,000 tons of coal are mined annually in France, while 38,500,000 are consumed. France, therefore, pays to the foreign countries annually about $30,000,000 for this excess of coal. The total water power in France is estimated to be 10,000,000 horse power, which is about equal to the combined power of all the steam engines in the world, but at present only one-tenth of this water power is used.

The British government recently received, by courtesy of the Navy Department, Washington, a copy of the chief constructor's report of the United States navy. The Admiralty people say it is deeply interesting to recognize the superior, effective use of electricity for more serious purposes than lighting. They are watching with interest the experiments with electric motors for moving the turrets of battleships. They are not enamored of the scheme, but are willing to learn.

It is stated, says The Electrical World, that there are over 1,200 independent telephone exchanges in operation in the United States, representing an investment of between $20,000,000 and $30,000,000. Of these exchanges 173 are in Ohio, which State heads the list; Illinois follows, with 169; New York, 164; Pennsylvania, 147; Indiana, 142; Iowa, 139; and Michigan, 133. The Detroit Telephone Company, Detroit, Mich., heads the list with the largest number of subscribers, having no less than 6,000. There are 2,000 exchange subscribers at Richmond, Va., and at Newark, N. J.

According to Electrical Engineering, of Chicago, the total number of telephones in use in various countries has been tabulated as follows: Province of Angola, 200; Austria, 20,000; Australia, 2,000; Bavaria, 15,000; Belgium, 11,000; British India, 2,000; Bulgaria, 300; Cape of Good Hope, 600; Cochin China, 200; Cuba, 2,500; Denmark, 15,000; England, 75,000; Finland, 6,000; France, 35,000; Germany, 140,000; Holland, 12,000; Hungary, 10,000; Italy, 14,000; Japan, 3,500; Luxemburg, 2,000; Norway, 16,000; Portugal, 2,000; Roumania, 400; Russia, 18,000; Senegal, 100; Spain, 12,000; Sweden, 50,000; Switzerland, 30,000; Tunis, 300; United States, 900,000; Wurtemberg, 7,000. These give a total of 1,402,100.

Prof. Koch, in Elektrotechnische Rundschau, recently described some very interesting experiments which seem to have a marked bearing on the conductivity of lightning rods. He formed a chain several meters in length with links of iron oxide and placed it in circuit with two accumulator cells and a galvanometer. This coherer was constructed in a room thirty meters from the galvanometer. When a spark was discharged in the vicinity of the chain the deviation of the galvanometer showed that the resistance of the circuit was reduced to one-thousandth of its normal value, and in a second experiment the resistance fell to one ten-thousandth of the normal. Prof. Koch concludes from these experiments that they may afford an explanation why lightning rods with poor conductivity are nevertheless effective in thunder storms. The oscillations produced provoke an enormous reduction of resistance at the proper instant to facilitate the flow of current through the conductor.

The Baltimore and Ohio Southwestern Railway Company are introducing electrically operated turntables in a number of their yards, it having been found that the saving in time and labor cost represents a good interest on the capital invested in the machinery and power. The experience of the company is founded upon the working for two and a half years of an installation connected with a 60-foot turntable, and which was devised by one of the master mechanics on the line. The motor was applied to an old car wheel by cast iron spur gear wheels, so as to reduce the speed. The car wheel and motor were attached to a frame which was hinged to the girder of the turntable, the car wheel to run on the circular rail or the track of the turntable. It was found that the weight of the frame, motor and car wheel was sufficient to give the necessary adhesion so that the tractive force would easily turn any engine. On trial, it was found that the heaviest engine could be turned completely around in fifty-six seconds. The cost complete, including the motor, was about $500, and after two and a half years' work the device is found to be as sound as when constructed.

Last summer many remarkable results were achieved in England by experiments in telegraphing without wires. The invention of this system, which is bound ultimately to supersede all existing modes of word communication, was credited to an Italian named Marconi, who in 1896 was able to communicate between the space in air of a few hundred paces, securing definite results by means of a very sensitive galvanometer. It now appears, according to Le Petit Journal, of Paris, that the real inventor of wireless telegraphy was a Frenchman named Bourbouze, the details of whose experiments, made during the siege of Paris in 1870, have just been made public by the French Institute. At the time of the investment of Paris by the Germans M. Bourbouze, then a tutor in physics at the University of Paris, was living at 340 Rue Saint Jacques. In November the wires leading to Paris had all been cut. It was then that M. Bourbouze conceived the idea of communicating by electricity and without wires. He experimented for many hours a day in his back yard. He was rewarded with success at last, and on the night of January 10-11, 1871, a dispatch was sent along the Seine from the Pont National to Saint Denis, a distance of nearly twenty-five miles. Before M. Bourbouze had a chance to perfect his invention the Germans had taken Paris, the war was at an end and the necessity for communicating with the army at Versailles removed. For some reason or other M. Bourbouze never completed his work. He employed the ground and water as conductors. It was through these mediums that communication was established last summer in the experiments at Bristol.

SELECTED FORMULÆ.

Nursery Powder.—The following powder is commended by the Seifen, Oehlen und Fett-Industrie as especially valuable in the nursery, and for the prevention of chafing in young children:

Salicylic acid	2	parts.
Talcum	100	"
Lycopodium	100	"
Starch, in finest powder	50	"
Zinc oxide, c. p.	20	"

Mix intimately by sieving several times. This powder not only is very grateful to the tender skin, but it rapidly heals chafes and other similar injuries.—National Druggist.

A Gold Colored Varnish for Tinned Iron.—A gold colored varnish for iron can, according to the Montan und Metallindustrie Zeitung, be prepared by rubbing 50 grammes of copper acetate to a very fine powder and by spreading it on a plate. The salt loses water and part of its acid and turns brownish; it is stirred with oil of turpentine, admixed with 150 grammes of copal lac, and heated to 70° C. (158° F.) Good rubbing together of the ingredients is essential. The liquid is bottled and the bottles are shaken occasionally and kept in a warm place. After a few days the varnish may be applied; the sheet metal is then dried under heating. The color depends upon the temperature at which the varnish is dried. The color appears first green, changes into yellow, gold color, and passes into orange and brown. The coloring is due to a reduction, and keeps well. If a green is to be produced, the heating must be gentle and five coatings be applied successively, always waiting until the varnish has become quite dry again.

Sealing Wax for Bottles.—Sealing wax for bottles belongs to the most ordinary sorts of sealing wax, and of course can only be colored with the cheapest kinds of coloring matter. Many manufacturers prepare sealing wax with a mixture of common pine resin, turpentine, chalk and the proper coloring matter only. The composition is applied by dipping the necks of the bottles into the melted mass, which, upon cooling, covers the cork with a layer of wax. To avoid brittleness, or "stickiness," shellac is generally added in about the proportion of 10 to 15 per cent. of the mass. Here are some formulas:

BLACK.

1. Take 6 parts of resin, 3 parts paraffin, melt together. Add 28½ parts of lampblack. Another color can be produced by taking about 5 to 7 parts to 100 parts of the mass, of chrome yellow, ultramarine, etc.

BLUE.

2. Shellac	7	parts.
Turpentine	6	"
Pine resin	3½	"
Magnesia	1	"
Chalk	2	"
Blue coloring matter	2 to 2½	"

BROWN.

3. Shellac	4	parts.
Turpentine	12	"
Pine resin	8	"
Gypsum	4	"
Chalk	4	"
Umber	4	"

The shellac for preparing chocolate brown sealing wax must not be too dark. The product of the above recipe is dark brown, and unbleached shellac and dark resin may be used for preparing it.

4. Gelatine	4	ounces.
Water	8	"
Dry white lead	3	"
Glycerine	½	"
Cochineal, sufficient quantity.		

Mix.—Pharmaceutical Era.

Economical Toning Bath for Proofs, etc.—Photographers often desire their trial prints, etc., which are not required to be permanent, to have the same tone as a finished photograph, but they do not care about wasting gold on them. Excellent tones may be cheaply obtained on proofs by using what is known as the "lead" toning bath, the formula for which is: Acetate of lead, ½ ounce; hyposulphite of soda, 4 ounces; water, 20 ounces (1 pint). Use hot distilled or rain water, otherwise a white insoluble precipitate is formed. Prints should be much darker than required when finished; portraits should generally be printed till the faces have a swarthy, unpleasant appearance. The proofs are put straight into the solution, and will immediately turn a mustard yellow color; in a few minutes, however, their tone will improve and pass through all the stages of red and brown till it reaches a brilliant purple, when toning is complete. The prints should now be washed for a quarter of an hour in running water, and then taken out and dried. I need not say, of course, that this is a combined bath. Carried out in this way, lead toning is fairly permanent. I have prints toned by this bath nearly two years ago, which show no signs of fading.—Photographic News.

Depilatories.—

1. Sodium sulphide, crystallized	3	parts.
Powdered quicklime	10	"
Powdered starch	10	"
2. Powdered quicklime	1	"
Sodium carbonate	2	"
Lard	8	"

Apply, and remove after two or three minutes.

3. Barium sulphide	equal parts.	
Powdered quicklime		"
Powdered starch		"
4. Powdered quicklime	8	parts.
Potassium carbonate	1	"
Potassium sulphide	1	"

This is known as "Chinese Depilatory," and, when finely powdered, should be kept in a well closed bottle.

5. Orpiment	1	part.
Powdered starch	10	"
Powdered quicklime	10	"

The general application of the powders is the same; they are mixed with water to form a paste, applied to the skin, and scraped off in two or three minutes.—Merck's Market Report.

THE USE OF ALUMINUM IN THE BRASS FOUNDRY.

THE recent increased use of aluminum by people heretofore manufacturing brass castings without the use of this metal has attracted considerable attention, and it is the object of this article to deal briefly with some of the advantages which can be derived by the use of aluminum in brass, and also how it is used.

First taking up the question of aluminum bronze, which is simply an alloy of copper and aluminum, in proportions varying all the way from 89 per cent. copper and 11 per cent. of aluminum to larger proportions of copper and as small a percentage as 4 of aluminum. This series is known as aluminum bronze and forms probably the strongest metal which is known to the arts. Owing to the large percentage of copper which this contains, however, it is not feasible to use this as a substitute or in competition with brass, and this metal is used principally where great strength is required, or where great strength and a non-corrosive metal are desired. Aluminum bronze probably is affected less by acid than any of the so-called "acid metals." This is also true of the action of salt water upon it, as has been shown by elaborate experiments which have been conducted by the government as well as some private individuals. Aluminum bronze is also used for bearing metals where a good antifriction metal is required. The method of introducing aluminum into the copper for the purpose of manufacturing aluminum bronze is one of the principal secrets in the successful manufacture of a good bronze, and has been previously described in these columns.

Taking up the question next of aluminum brass, the percentage of aluminum which is used varies from one-tenth of one per cent. to a 10 per cent. mixture. The lower percentage of aluminum in brass is used more particularly to give the brass additional fluidity, and consequently enabling castings to be manufactured which will appear sharp and clean, and results can thus be obtained by the use of a very small percentage of aluminum, which it is impossible to obtain with the ordinary brass mixtures without its use. Also it is possible to use a cheaper grade of zinc when some aluminum is added and considerable strength is required, provided the zinc does not contain too much lead as an impurity. The presence of much lead in zinc, when the most inferior grades of zinc are used with aluminum, causes the lead to sweat out on the surface of the castings and discolor them. When this action takes place, however, it is by all means advisable for the foundryman to change his brand of zinc, for such zinc used without aluminum is hardly worthy of the name.

The way in which aluminum should be added to brass is to first make a mixture of aluminized zinc of some standard percentage. This aluminized zinc generally contains 10 per cent. of aluminum, and is made by taking a plumbago crucible and melting in it 10 pounds of aluminum. After the aluminum is melted, zinc should be added as fast as the molten metal will take it up, until all of the 90 pounds have been added. Then the crucible is removed from the fire and the contents cast into moulds of convenient form and size, which can afterward be broken up and this aluminized zinc introduced into the copper with the other zinc, and in such proportions as will give the required amount of aluminum in the finished casting.

When aluminum is used, as previously stated, in small percentages, from one-tenth to two-tenths per cent., that is, from two to four pounds of aluminum to a ton of brass, its action is more toward clearing the metal of impurities and giving additional fluidity rather than giving additional strength, and it is not until one-half of one per cent. is added that an increase of strength is secured in the finished casting. In some electrical work the higher grades of aluminum brass have been very successfully and advantageously used for such work as the brass castings made in connection with the overhead trolley work, where a great deal of strength is required. These castings are desired of such strength that they will withstand the enormous strain brought on them, and the breaking of the same will, of course, inconvenience the working of the line.

Aluminum brass is also being used by the United States navy in some of their finer work, and some of the shipbuilders are now supplying it very largely, as they find that they can afford to do this at their own expense, owing to the rigid inspection which the government gives the work, and by the very small number of castings which are rejected, owing to the use of aluminum in their brass, it more than repays them for any additional expense which they have gone to in the matter. It has also been found by careful experiment that the introduction of aluminized zinc in brass causes a much smaller loss in the zinc than if aluminum is not used; that is, it seems to prevent to a certain extent the zinc burning or volatilizing should the metal become overheated, which is always the case to a certain extent, for it is never possible to weigh out of the crucible as much metal as has originally been placed in it.

A good deal of brass is now made and used in connection with acids, and is known as "acid brass," and contains copper, tin, lead and antimony. This, properly speaking, is more nearly a bronze than a brass, and it is possible to manufacture with copper, tin and a small amount of aluminum a brass which seems to be superior in withstanding the corrosion of most acids. The percentage of copper which is used is a little more than is ordinarily used, and the percentage of tin less. The use of aluminum is found to be particularly advantageous in working over old gates and scrap which naturally accumulate around a foundry, and that may have dirt and impurities in it, which would ordinarily make it almost impossible to pour and cast in any satisfactory shape. It is on the same principle, as above stated, that more satisfactory results can be obtained by the addition of a small amount of aluminum when inferior zinc is used in brass.

Some of the large brass mills that are manufacturing sheet now use a small amount of aluminum in their sheet brass, as it seems to enable them to cast their ingots more perfectly and enable them to roll not only a stronger sheet, but one with a more perfect surface than can be obtained without the use of aluminum. This whole subject, however, of the use of aluminum in casting brass is to a certain extent new to the majority of brass foundries, and is little talked of by those who do use it, for the reason that where they have secured advantageous results they have kept it to themselves and have endeavored to reap the benefits which would accrue to them when there is very close competition.

In first attempting to use aluminum in brass foundries there will, of course, be more or less difficulties to be overcome, owing to the men not being familiar with and knowing exactly how to handle the metal; but the principal reason for not meeting with complete success is because the aluminum is not properly introduced, and in order to obtain the best and most satisfactory results it is absolutely necessary that it should be introduced as above described. This is principally from the reason that copper melts at about 2,000 degrees Fahrenheit, and if a small amount of aluminum which melts at about 1,200 degrees Fahrenheit is introduced into a large volume of copper, it comes to the surface and is oxidized, and the full advantage effected by the aluminum is not felt. And again, if any of the aluminum does oxidize, some remains in the brass or bronze, as the case may be, in the form of an oxide of aluminum, a white powder which will show out on the surface of the metal if it is turned to a finished surface, or if the metal is rolled into a sheet and then polished.

If, however, the aluminum is properly introduced, there is no reason at all why any of it should be oxidized, and a most perfect surface can be obtained, and the finish on such a metal is of a higher quality than can otherwise be secured. It is to be noted, however, that it is not desirable to use aluminum in brass which is to be dipped, for the reason that the introduction of aluminum gives the brass an acid-resisting quality, and no matter how small a percentage of aluminum is used in brass, if it is intended for dipping purposes the effect of it will be quite apparent, and it is impossible to obtain such a finish as if no aluminum were used. But this very quality makes the presence and use of aluminum in brass particularly advantageous and desirable for any place where the brass must be used to withstand corrosive action, either from acids, water or salt air.

In making brass castings, owing to the additional fluidity mentioned above, it is possible to increase the number of patterns on the gate, where a lot of small castings are being made from one-third to one-half over what can be cast if no aluminum is present. This is one of the principal advantages and uses for aluminum in brass castings, where the aluminum is only used in very small quantities. The presence of aluminum in either brass or bronze tends also to change its color slightly. The larger percentage of aluminum that is used, the lighter the finished article will appear. In the case of aluminum bronze, 95½ per cent. copper and 4½ per cent. of aluminum will give a color which is almost impossible to detect from 14 karat gold, and there is to-day a large line of table flat ware which is manufactured and sold on the market under the trade name of "gold aluminum," which has this color. It is to be noted, however, that the addition of very much aluminum will materially increase shrinkage, and this should be provided for in casting work by using larger gates and higher risers.

In saddlery hardware, especially, where a great deal of brass is used, and used in very small articles, the addition of aluminum has been found to be particularly desirable; for, owing to the very close competition, the manufacturers of this class of goods have been obliged to use a very poor grade and cheap quality of brass, and by the addition of a small amount of aluminum they are not only able to get a casting which is stronger and superior in quality, as far as actual strength is concerned, but they are enabled to cast more pieces from a single gate or flask, and consequently considerable time is saved in making up the moulds for such articles, and the saving thus accomplished forms a large item in the competition which is to be met, owing to the reduced foundry cost of the article manufactured by the use of aluminum.

It is to be noted in both the alloys of copper, zinc and aluminum, and also copper and aluminum, that the use of too much aluminum will give a very brittle metal. On the copper end of the series the dividing line between the strong and the brittle alloys seems to be exactly at the point where a very decided change in color takes place; that is, where the metal changes from the yellow color of gold to the white color of silver, and this change takes place in a mixture containing between 80 and 85 per cent. of copper. Alloys which contain more aluminum than this, as, for instance, 25 or 30 per cent., become so brittle that they will break if they are dropped on a stone or iron floor, and the machining also becomes very difficult, as the metal chips and does not turn smoothly. In some special cases these higher alloys can be used—if no strength under a blow is required. They have a very hard surface and take an excellent finish.

It is also to be noted that with the use of very much aluminum, that is, for percentages from 1 to 2 per cent. in either brass or aluminum bronze, that the strength increases to a very noticeable extent on the second and third melting. This is accounted for by the fact that a more perfect alloy is formed between the metals and the aluminum on each successive melting. Taking, for example, ordinary castings of 90 per cent. copper and 5 per cent. tin and 5 per cent. aluminum, on the first melting these are worth about 41,000 pounds per square inch, as their ultimate tensile strength. These castings on the second melting are worth nearly 43,000 pounds. Mixtures of 10 per cent. copper and 10 per cent. tin usually give only from 33,000 to 34,000 pounds as their ultimate tensile strength; and when these proportions are increased to 20 per cent. of each metal the tensile strength is only about 2,000 pounds, and the metal is found to be extremely brittle. The maximum shearing strength of the copper, aluminum, tin alloys is also about the point of the maximum tensile strength, that is, where there is from 5½ to 6 per cent. of each metal present. The maximum tensile strength of aluminum bronze is also at about the same point as the amount of total alloyed ingredients, that is when it contains from about 1 to 10 per cent. of aluminum.

It is to be noticed that the addition of about 6¼ per cent. each of aluminum and tin to copper increases the tensile strength nearly three times and makes it a very much harder and a denser metal, and consequently of more value in the arts. There is one point to be noted, however, and that is, when very much aluminum is used, it makes the metal a little more difficult and expensive to work, if very much tooling or machine work is to be done on it; but as this is generally a secondary consideration where much strength is required, it is of but little importance, as the great bulk of aluminum which is used in connection with brass is used principally for giving additional fluidity and enabling the foundryman to use cheaper metals and secure better results than could possibly be secured by the use of the same metals were aluminum not used.—Aluminum World.

HOUSE FLIES, GNATS AND MOSQUITOES AS DESTROYERS OF PATHOGENETIC MICROBES.

MARPMANN, of Leipzig, in an article on "Flies as Destroyers of Microbes," remarks that it is a curious fact that popular conceits on questions whose solution science has in vain attacked very frequently guide the way to truth. Among other great problems he points out that of the cause and spread of epidemics, which seems thus about to be cleared up. Travelers, he says, tell stories, some of them from personal experience, others related to them by natives, concerning phenomena which they cannot explain; such, for instance, as the story that in certain living rooms, in which tuberculous patients had resided, tuberculosis had been conveyed to perfectly healthy men and women by means of bedbugs. Many portions of the tropics are free from certain diseases, but swarm with mosquitoes, and in other portions, free from the latter pests, these diseases prevail as epidemics.

"Apropos of such popular beliefs," adds Marpmann, "I would cite the following, which is the more interesting as it came from the mouth of a physician in high standing, who flourished before bacteriology was thought of, and which have been partly explained by recent discoveries of that science:

"Between the years 1840 and 1850 there flourished in the city of Hanover a certain surgeon—Court Counselor Dr. Hoelscher, who also taught in the school of surgery maintained at that point. In his clinics he was in the habit of telling the following anecdote, which at the time was not credited, and was subsequently forgotten. Hoelscher was very particular in regard to cleanliness in his operations, not only in his own person, but insisted on scrupulous neatness in all of his assistants, the service and surroundings. In this particular he declared that he took pattern after a certain surgeon of the sixteenth century, of forgotten name, but who also formerly lived in Hanover. This old time predecessor before every operation took a 'Voll Bad' (i. e., bathed the entire body), and put on clean clothing from head to toe, putting on over his other clothing a sort of long shirt or gown of pure white linen, freshly laundered. It was the general opinion of that day that this was carrying cleanliness a little too far, and while the surgeon was always very fortunate in his operations, instead of attributing it to cleanliness, they laid it to his great skill. These facts Hoelscher used to relate with great gusto to his students. On one occasion Hoelscher said that 'his master and teacher believed that flies played an important role in epidemic disease,' and that he believed that this was a fact. Both of them, his teacher and himself, had become convinced of the truth of the idea, by repeated observation, that, in years where flies were plentiful, epidemic disease was either totally absent or was mild in nature, and, on the contrary, years when flies were few or absent were marked by widespread and severe epidemics.

"Now these two little bits of information are very interesting in the light of the science of to-day. That in the sixteenth century, upward of three hundred years ago, a surgeon should have anticipated the antisepsitical ideas of to-day, and should have prepared himself for operations by the most scrupulous attention to cleanliness, and, moreover, operated in regular operation garb, are facts known to but very few, and for this reason I have introduced the matter here. Moreover, that flies were regarded, upward of a half century ago, as a means of protection against epidemic disease was directly in the line of my investigation, and it behooves me to record the fact. That house flies, gnats, and blow flies are annoying pests, and that they may be dangerous pests, whose sting or bite may under certain circumstances cause serious and even fatal blood poisoning, is known to everybody. Bees, wasps, etc., are relatively harmless, since a single wasp sting, or the stings of a number of bees, rarely or never give rise to blood poisoning, the reason being that in the latter class of injuries the pain is caused by the insertion of the sting and injection of the poison of the insect, while in the former case the insects are conveyers of germs, with which they inoculate the body and thus give rise to septicæmia by the multiplication of septic organisms. Some fifteen years ago I published in the Archiv für Hygiene the results of an investigation from which I arrived at the conclusion that our common house flies, both the stinging and the sucking sort, contribute to the distribution of micro-organisms and that under certain circumstances they are the carriers of pathogenetic bacteria. Very recently I again took up the subject in order to discover, if possible, whether or not these pathogenetic bacteria, bacilli, etc., undergo any alteration during their passage through the digestive tract of these insects; and whether the intensity of activity of the micro-organisms was not diminished thereby.

"As stated, the house fly of the ordinary sort, provided with a sucking tube, cannot cause septicæmia,* but it can carry pathogenetic microbes from infected spots and deposit them upon the surface of nutriments intended for human consumption, and in this manner can assist in spreading epidemic diseases. When these flies are closely watched, it will be observed that they frequently vomit up their food. A little droplet of clear liquid appears at the end of the proboscis, and if this be smeared on a cover glass and examined under proper technique, it will usually (always, in my experiments) be found to contain various bacteria, some of which are bacilli and some micrococci. Besides these, some other organisms derived from the excrement were

*That the ordinary sucking house fly can cause septicæmia the learned professor would have admitted, had he reflected a moment. The micro-organism giving rise to septicæmia, if deposited in an open wound, will multiply under favorable circumstances and by invasion of the tissues give rise to blood poisoning, as surely as though deposited under the skin by the sting of an insect. Numerous cases of blood poisoning have been recorded where this was the only possible method of infection.—Editor National Druggist.

found to be pathogenetic, so that it may be accepted as proved that the house fly can spread pathogenetic micro-organisms on our foods, etc.

"The stinging insects, gnats, flies, mosquitoes, etc., can transfer pathogenetic micro-organisms directly from corpses, and from other sources directly into the blood of man and beast; and thus set up a direct septicæmia or infection. Both of these facts are well established, and hence we are correct in regarding this class of insects as directly inimical to man."

Our author then describes at length the experiments made by him with the view of determining whether the views of the old physician (Dr. Hoelscher) had any basis in fact or not, dividing his experiments in three parts, in order to ascertain, first, whether the pathogenetic bacteria are weakened (in their toxic effects) by passing through the digestive canal of insects; secondly, whether these probably weakened bacteria can give immunity to a second infection; thirdly, whether bacteria introduced directly into the blood, by the sting of an insect, can serve as a protective inoculation; and, finally, whether the infective power of the ferment may be weakened by the insect through one or another of these operations.

We will not attempt to follow Dr. Marpmann through these experiments, but will give the conclusions to which the result of these led him. After stating the great difficulties in the way of proving any one of the propositions by experimental processes, he says:

"The experiments conclusively demonstrate that flies and other insects convey any adherent material, taking it up on their feet and through the sucking or stinging apparatus, from festering or rotting matter, excrement of man and beast, and similar excreta and waste; that they convey these germs to our food stuffs, where, under auspicious circumstances, the ferments multiply, and very materially increase the number of pathogenetic microbes to which we are exposed.

"Secondly, it has been demonstrated that the pathogenetic septic bacteria are weakened by the passage through the body of the insects. The experiments showed that after twelve hours interim, about 30 per cent. of the flies which had been infected by a bacterial culture on mice were entirely free from pathogenetic microbes.

"Thirdly, our experiments show considerable difference exists between individuals as regards susceptibility to insect poisons. Healthy, full-blooded persons are less susceptible than leukæmic individuals. The annihilation of pathogenetic germs is apparently accomplished, in man, in a more direct manner by the red blood corpuscles than by the white corpuscles which abound in leukæmic blood. The phagocytic theory does not hold good when applied, for instance, to leukæmic women, who notoriously are the greatest sufferers from insect bites—provided, of course, that we accept the theory that the stinging flies, gnats, etc., stand in the front rank as carriers of pathogenetic microbes, and that they can inoculate the latter on or in the skin by their stinging apparatus.

Fourthly, we have shown that it is at least probable that these insects have either great powers for bacterial destruction, or in some unexplained manner produce, through the medium of their sting, immunity to bacterial effects. I think that we may answer our fourth question affirmatively, and state that the infective powers of pathogenetic germs are weakened by insects, and that in regions rich in insect life and especially in flies, gnats, etc., fewer and milder epidemics of germ diseases are liable to occur than in regions poor in or devoid of insects, and, consequently, in years of plenty of such insects than in years of poverty in the same.

"Epidemic mycoses fluctuate in character and intensity from year to year, and, in my opinion, there is a connection between the phenomena and the paucity or plenty of insect life.

"For thirty years bacteria have occupied the foremost position in scientific research, yet while we can safely say that these investigations have brought us much nearer to an understanding of the phenomena of decay and fermentation, as well as of the processes of life in health and disease, bacteriology has not yet discovered the true explanation of a single biological process or of the cause of a single disease, and medicine stands to-day just where she stood several decades ago, as far as her understanding of the etiology and therapeutics of epidemic disease is concerned. The hygienist and surgeon, it is true, can point to the fact that the introduction of pure water supplies, the improvement of drainage, the condemnation and destruction of infected dwelling houses, the control of food stuffs, etc., have worked a great improvement in the conditions of life. They can also show that the infection of wounds occurs always in connection with the development of certain micro-organisms or ferments, but we are still in ignorance of how, or in what manner, these microbes influence cell life, and also as to the influence exerted by these microbes upon the appearance and development of infectious diseases.

"In all of my experimentation, I beg that it will be remembered, I have never yet ascribed to the bacterial cell, alone, the phenomena of pathology, but have held, in common with Pettenkofer, that to the bacterial cell, the life of the physical cell, an unknown something, must be fitted before we can exactly describe all of the facts, or produce the image of any disease whatever.

"It is to be hoped that a time will soon come when science will cut loose from the extreme bacteriology of the present day, and build, for the future, only on the firm basis of the few individual facts that bacteriology has established. From this point of view only would I have my experiments as to the connection of insects and bacteria regarded, and only those points accepted which have been clearly demonstrated. I have demonstrated the fact that certain flies infected with bacteria produced on mice the specific effects of these bacteria; that these mice developed a certain partial refractiveness toward subsequent inoculations; that the flies themselves gave evidence of a similar partial immunity against inoculation or infection. What must yet be demonstrated and made clear is that the disease of the mice was caused by the infection from the flies. Whether the protection thus afforded is the case as regards all pathogenetic bacteria; whether, too, all infectious diseases are true bacterial infections—these are questions the solution of which must yet be worked out through the medium of pathological bacteriology."—National Druggist.

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